THE UNIVERSITY OF ALBERTA

INELASTIC PROPERTIES OF CONCRETE

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

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OF MASTER OF SCIENCE

DEPARTMENT OF CIVIL ENGINEERING

by

WILLIAM G. LESLIE

EDMONTON, ALBERTA

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Inelastic Properties of Concrete" submitted by William G. Leslie in partial fulfilment of the requirements for the degree of Master of Science.

ABSTRACT

It is well known that unstressed concrete shrinks in air and when subjected to a continuously applied stress will undergo an additional time-dependent deformation commonly called creep. These time-dependent movements may profoundly affect stresses and deflections of concrete structures.

The objects of this experimental investigation were to design and construct an apparatus which could be used to determine the flow (inelastic properties) of concrete under a sustained load and to use this apparatus to observe the effect of the water-cement ratio, type of aggregate and age at loading on the rate and magnitude of flow. Lightweight concrete made with expanded shale aggregates and regular concrete made with sand and gravel were studied.

The test findings indicate that the flow of lightweight concrete is of the same order of magnitude as for natural aggregate concrete of compatible strength.

ACKNOWLEDGEMENTS

The author is indebted to Professor G. Ford, under whose guidance this thesis was written, for the valuable assistance received on all aspects of the program. Thanks are extended to the Research Council of Alberta for their support during the summer of 1958 and to the University of Alberta for the special grant used to purchase testing equipment. Thanks are also extended to the staff of the Department of Civil Engineering and to the post graduate students for their interest and many helpful suggestions. The author is also indebted to Mrs. C. Noble, Mrs. P. Bourbonniere, Mr. J. Wigham and Mr. K. Jegodtka for their assistance in preparing this manuscript.

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INTRODUCTION

Creep and shrinkage have important effects on the stresses and deflections of prestressed concrete structures. It is essential that a design engineer be able to compute, within reasonable limits, the magnitude of creep and shrinkage to be expected in a concrete structure at any time under any load so that any changes in stresses or deflections may be envisaged and allowed for in the design.

Under no external load shrinkage creates a system of stresses in a concrete member because the shrinkage tendency of the exterior fibers is resisted by the interior fibers of the member which do not contract as much as the surface fibers. Creep greatly moderates the severity of shrinkage stresses. Usually, there are permanently applied loads on the concrete member, and creep and shrinkage combine to affect the behavior of the structure. For example , if there is movement of the abutments of a two-pinned arch when loaded, creep of the concrete will moderate stresses caused thereby and tend to restore conditions to those envisaged by the designer--an elastic structure with immovable abutments. Creep and shrinkage may have detrimental effects on a structure also. For example, the shortening

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of the beam in a prestressed portal frame due to creep and shrinkage alters the horizontal reaction at the base and thus creates secondary moments.

Definitions

Shrinkage - The word shrinkage as used herein conforms with the definition of the joint ACI - ASCE, Committee 323 report which appeared in the ACI Journal, October, 1952. Shrinkage is defined as the "contraction of concrete due to drying and chemical changes, dependent on time but not on stresses induced by external loading".

Creep - Creep as used here, conforms with the joint ACI - ASCE Committee 323 definition also. It is defined as "inelastic deformation dependent on time and resulting solely from the presence of stress and it is a function thereof".

Plastic Flow - Plastic flow, as defined by Staley and Peabody(46), is "the difference between the total strain of a loaded specimen and the shrinkage strain of an unstressed specimen during the same time interval".

Flow - For the purpose of this thesis flow is defined as the total strain of the loaded specimen minus the instantaneous strain observed on loading the specimen. The flow at any time is considered to be equal to the sum of the strains resulting from creep and shrink-

age. All factors that influence creep are considered to affect flow in the same manner and theories applicable to creep are applicable to flow.

Historical Review

Studies to determine the magnitude and contributing factors involved in the creep of concrete have been conducted for many years. Lorman(20), credits Woolson as being the first person to conduct experiments with regard to creep in concrete. Woolson(54) published the results of his investigations in 1905. Subsequently other research workers entered this field and by 1925 sufficient facts concerning concrete creep had been established to warrant inclusion of this phenomenon as an important factor in the Stevenson Creek Arch Dam investigation and Davis(7) was commissioned to conduct laboratory tests dealing with creep of concrete. The results obtained in the laboratory were valuable as they enabled research workers to arrive at a satisfactory explanation of the changes in volume of the concrete in the dam. In 1927, Faber(10) published a paper showing that creep was a factor to be considered in the design of reinforced concrete. About the same time Glanville(14) started a series of laboratory experiments and subsequently introduced what perhaps were the first theoretical calculations involving the properties of creep. Since

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that time many investigators, Ross(37,38) Shank(43), Thomas(48), Lyse(22), Best(3), Freudenthal(12) and Viest(55), have published the findings of their observations together with suggested mathematical expressions for predicting the amount of creep that would take place in a concrete subjected to various conditions. A summary of creep theories appears in Chapter II.

Despite the large amount of work accomplished by many investigators during the years since 1905 the published experimental data are limited in scope. This is due to the large number of physical variables involved, (Troxell(49) lists nine), and to the lack of correlation between the various experimental investigations. It is, therefore, still very difficult to estimate the amount of creep that will occur in a given concrete. To remedy this situation extensive studies are being conducted throughout the world at the present time by investigators such as Jones(16,18), Best(3), L'Hermite and Ross(37).

In order to learn more about the influence of various factors upon the flow of concrete a number of tests on plain concrete cylinders held in compression were begun by the author in the spring of 1959. These tests were the first in a proposed series to evaluate the effect of various physical variables on the flow of concrete.

Factors Influencing Creep

When a concrete member is subjected to a sustained load it undergoes a time-dependent deformation that is influenced by the following variables:

(1) Aggregate-cement ratio

(2) Water-cement ratio

(3) Type of aggregate and its grading

(4) Composition and fineness of cement

(5) Age at time of loading

(6) Intensity and duration of stress

(7) Moisture content of the concrete

(8) Humidity of the ambient air

(9) Size of the member

(10) Admixtures

Fluck and Washa(11) and others discussed the effect of each of the above variables. The following brief summary indicates the effect of each variable.

(1) Aggregate-cement ratio: Test results have shown that creep of concrete decreases as the volume of cement paste decreases.

(2) Water-cement ratio: Most investigators claim that the creep of concrete decreases as the water-cement ratio decreases and if a constant water-cement ratio is maintained, creep increases as the amount of cement paste increases. Lyse(45), however, claims the relation of creep to the percentage of paste in the concrete is the same regardless of the composition (water-cement ratio) of the paste.

(3) Type of aggregate and its grading: To obtain a concrete that will exhibit low shrinkage and creep, hard dense aggregates are desirable. Test results show that under comparable conditions, concretes containing different aggregates exhibit different amounts of creep. Some common aggregates listed in order of decreasing susceptibility to creep are; sandstone, basalt, granite, quartz, and limestone. Test results also show that creep and shrinkage decrease as the maximum size of coarse aggregate increases and that both shrinkage and creep decrease when well graded aggregates with low void contents are used.

(4) Composition and fineness of the cement: The composition of cement affects creep primarily through its influence upon the degree of hydration. Cements which harden slowly, such as low-heat portland cements, are more susceptible to creep than cements which hydrate more rapidly. Davis and Troxell(8) state that fineness is probably

not as important as composition. It appears that for low-heat cement, creep is greater for coarser cements, but the reverse is true for normal portland cement.

(5) Age at time of loading: The ability of concrete to carry sustained loads without excessive creep is a function of cement hydration, and under given conditions, the greater the degree of hydration at the time of load application, the lower the rate and total amount of creep.

(6) Intensity and Duration of stress: Within the range of usual working stresses creep is approximately proportional to the sustained stress. At stresses above normal working stresses the rate of creep increases as the magnitude of the sustained load is increased. Creep increases rapidly during the early portion of the sustained load period and continues to increase but at a decreasing rate with time. Increases in creep have been reported in samples subjected to load for 25 years.

Fluck and Washa(11) note that the instantaneous strain due to the initial load application is greater than any recovery strain value and that plastic recovery after release of the applied stress is comparatively small and is generally obtained in a short time.

(7) Moisture content of the concrete: The moisture content of the concrete affects creep through its influence upon the rate and degree of hydration of the cement. Protection of concrete members against

rapid drying is beneficial in reducing the rate and ultimate amount of creep.

(8) Humidity of the ambient air: Test results (11,50) show that the rate and ultimate magnitude of creep increase as humidity of the storage air decreases. Concrete under load in an atmosphere of 100 percent humidity will attain a creep strain approximately equal to the instantaneous strain obtained when the load was first applied. When the humidity is reduced to 50 percent, the ultimate creep is about three times as great as the instantaneous strain.

(9) Size of the member: More creep is noted in small members than in larger members. Small members respond more rapidly than large members to moisture changes, therefore, under similar curing conditions, the degree of hydration and moisture content of small and large specimens may be different at the time of loading resulting in different rates of creep.

(10) Admixtures: Only a small amount of work has been done to determine the effects of admixtures on the creep properties of portland cement concrete. Existing evidence tends to indicate that approved air-entraining agents have no appreciable effect on creep whereas the use of pozzolans tends to increase creep.

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<u>Purpose of this Study</u>

This investigation had two main objectives. The first objective was to design and construct apparatus which could be used to determine the flow (inelastic properties) of concrete under a sustained load. The second objective was to use this apparatus to determine the flow and shrinkage which would occur in portland cement concretes made with local sand and gravel aggregates and in concretes made with lightweight expanded shale aggregates.

<u>Research at other Laboratories</u>

Before embarking on this testing program a survey was made of all available literature pertaining to the proposed program and correspondence was established with a number of research workers and organizations engaged in the determination of creep and shrinkage in concrete. A list of references is included in the Bibliography together with names and addresses of all research workers contacted before, during and after the completion of the experimental program.

<u>Basis of the Study</u>

The data included in this study were obtained experimentally. Loading rigs and strain measuring equipment were designed and constructed. Regular concrete aggregate composed of sand and gravel,

and lightweight concrete aggregate composed of expanded shale particles were used in mixes designed to have compressive strengths of 3000, 4000 and 5000 psi at 28 days. Strain measurements were conducted and readings recorded on stressed and unstressed samples over periods of time varying from 93 to 160 days.

The information obtained from the experimental program was described and studied under the following headings:

Development of Test Equipment

Description of Test Materials and Conditions

Test Procedure

Results

Conclusions and Recommendations

CHAPTER II

THEORIES OF CREEP

Creep of concrete is a yielding of the concrete resulting from the action of a sustained stress. It may be due partly to viscous flow of the cement-water paste, closure of internal voids, and crystalline flow in aggregates, but it is believed that the major portion is caused by seepage of colloidal (adsorbed) water from the gel that is formed by hydration of the cement.

Viscous Theory

Thomas(47), Arnstein and Reiner(1) and others propose the theory that the cementatious material in concrete behaves in a viscous manner when loaded and that the aggregate is an inert suspension which does not flow under load. When the concrete is loaded, the cement flow is resisted by the presence of the aggregates so there is a gradual transfer of load from the cement to the aggregate. This gradual transfer of load accounts for the observed gradual reduction in creep with time. Neville(28) thinks that the aggregates also contribute to creep as there would be gradually increasing elastic deformations of the aggregates as the load shifts to them and in some cases flow may occur in the aggregate. The viscous theory does not explain the reduction of volume of concrete under load.

Mechanical Deformation Theory

Freyssinet(13) attributes creep under load to a deformation of the capillaries within a cement paste caused by the pressure of water and air phases within the paste. When the load is removed the water and air pressures tend to restore the capillaries to their original shape. Upon application or removal of load there is a "tendency of the whole system towards maximum stability". There appears to be no experimental evidence corroborating this theory.

Plastic Theories

Vogt(56), Bingham and Reiner(4), Glanville(14), Probst(33) and others have suggested that creep is due to slippage along planes in the crystal lattice in a manner similar to the deformation of metals. However, plastic flow of metals is a nonelastic deformation which occurs only when a particular stress is exceeded. Glanville's experiments show that nonelastic deformations occur in concrete even at very low stresses. Also, this theory is not compatible with considerations of constant volume since creep in concrete is accompanied by a volume reduction.

Seepage Theory

Lynam(21) says that water may be contained in concrete in three forms: free water mechanically held within the capillaries of the gel; colloidal or absorbed water, and chemically combined water. Both shrinkage and creep are described as the result of the loss of colloidal water, though in one case the water is drawn out by evaporation and in the other forced out by pressure. It is assumed therefore that shrinkage and creep are inter-related phenomena.

Ross(34,35) and Seed(40) agree with Lynam's theory of seepage and propose the following explanation of the creep process. When a system composed of an elastic solid and a viscous fluid is subjected to a pressure the vapour pressure of the fluid is immediately increased and the fluid will tend to squeeze out. This results in a progressively increasing stress on the solid. As the stress on the solid increases, the stress on the fluid will correspondingly decrease and the rate of expulsion of the fluid will be reduced.

The rate of expulsion of the water is not only affected by the rate of load transfer to the solids but is also affected by the moisture gradient between the gel and the surrounding medium and on the quantity of moisture in the gel.

Maney(24) believed that seepage does not exist because he found little change in the weight of specimens under load as compared with

the loss in weight of unloaded specimens. However, if a specimen does not lose weight it does not necessarily mean that water is not being squeezed from the gel. Concrete contains many small voids which may exert a negative pore pressure. Under the action of a sustained load, some of the adsorbed water may be forced from the gel into the pores creating free water in the pores; this will relieve the negative pore pressure and creep will take place without a loss of weight of the specimen. An example of the above condition would be the concrete at the center of a large mass from which no moisture movement could take place but where creep may be encountered.

Summary of Theories

Neville(28) proposes the following hypothesis after reviewing the majority of creep theories:

"What is normally measured as creep consists of true creep (viscous in nature, with a gradual transfer of load to the aggregate) and increased shrinkage (seepage due to evaporation and external force). The magnitude of creep depends on the force applied and the properties of concrete, but is independent of factors such as curing conditions, humidity, temperature, etc. The variation in these affects shrinkage only".

CHAPTER III

DEVELOPMENT OF TEST EQUIPMENT

To determine the flow of concrete it is necessary to be able to apply and maintain a constant stress on the test specimen and to be able to measure the subsequent strain occurring in the specimen. The specimens investigated in this program were cylinders 6 inches in diameter and 48 inches long. The large size of the specimens suggested the adaption of a loading frame design developed by the Portland Cement Association. With this design in mind an investigation was conducted to see if large compression springs capable of carrying a load of 25,000 lbs. could be obtained at a modest price. Numerous used springs were obtained from the Canadian Pacific and Canadian National Railways and tested in the laboratory. It was found that most of the springs could not meet the specified load requirement. Some of the springs that did meet the load requirement had to be rejected because of their large dimensions which would have resulted in very large loading frames. The remaining springs were rejected because they consisted of a set of springs nested one inside the other. It was felt that a nest of springs would be unsuitable because the spring constant varied as each spring

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of the set was compressed. The variance in the spring constant could result in a large loss of load due to a small recovery of the spring when maintaining a load.

After unsuccessfully trying to locate a satisfactory used spring, various spring manufacturers were requested to submit tenders to supply 54 springs conforming to the following specifications suggested by the National Research Council.

Coiled compression spring

Capacity - 25,000 lbs.

Outside diameter of coil - 6 inches

Free height - 12 inches

Solid height - 10 inches

Coil bar diameter - $1\frac{1}{2}$ inches

Ends square and ground

The lowest tendered bid was accepted and the springs were ordered in July 1958. A September delivery date was set but unforeseeable circumstances, including a strike of steel workers, did not allow the order to be completely filled until January 1959.

Attempts were also made, during the above mentioned period of time, to obtain an apparatus to measure the strain that would occur in the test specimen as a result of the sustained load. Simmonds(56),

in an investigation of the Stress-strain relationship of a lightweight concrete used an extensometer to measure strains occurring in a 6" X 12" concrete cylinder as the cylinder was loaded to failure. It was suggested that an apparatus similar to an extensometer could be used in this program to measure flow occurring in the concrete. Using the extensometer as a guide, an apparatus called a "compressometer" was evolved and used in the determination of flow. The compressometer is described on page 27. A loading frame design based on a Portland Cement Association design, was completed during the evolution of the compressometer. Plate 1. Eighteen loading frames and compressometers conforming to design specifications, were ordered from local machine shops.

For each specimen that was subjected to a sustained load, a companion specimen poured from the same mixture, was left in an unloaded state. The unloaded specimens were used to determine the magnitude of shrinkage in both the loaded and unloaded specimens. The apparatus used by other investigators to determine shrinkage consisted of a mechanical strain gauge to measure changes in distance between gauge points cast in unloaded specimens. It was decided that a similar apparatus would be used. Several types of gauge points were considered and it was decided to adopt a type recommended by

Jones(57) and used at Texas A & M College. Plate 3 . A "Demec" gauge was used to measure changes in distance occurring between these gauge points.

When the constituent parts of the loading rigs were received, "SR-4" wire resistant strain gages were attached to the tie rods and moistureproofed using procedures recommended by the gage manufacturer. The strain gages were subsequently used to determine the stress in the tie rods and thereby the load on the concrete sample. Calibration curves of load versus strain were determined for each tie rod by loading the tie rods in a hydraulic testing machine. The calibration curves are included in Appendix 1.

After completing the calibration of the tie rods one loading frame was assembled. A concrete cylinder, 6 inches in diameter and 48 inches long, was cast from a mix designed to have a 28 day compressive strength of 3000 psi. Following a short curing period, the cylinder was capped and placed in the loading frame. A compressometer was placed in position and a load was applied to the cylinder with a hydraulic ram. This load was maintained for two weeks.

Following the application of the load, readings of the compressometer were taken and recorded every day. Gauge points consisting of 9/16" steel rods had been cast in the concrete cylinder and changes

in the distance between the gauge points as determined with the "Demec" gauge were also recorded daily. Unit flow, determined from the observed readings, showed good correlation between the two methods of measurement. This indicated that the equipment could be expected to perform satisfactorily and the testing program using the designed mixes was started.

CHAPTER IV

DESCRIPTION OF TEST MATERIALS AND CONDITIONS

Materials

Aggregates used in this program consisted of natural sand, crushed river gravel and lightweight expanded shale. The sand and gravel are typical of the natural aggregates to be found in the Edmonton area.

The expanded shale aggregates are produced in Calgary and are available in the following sizes: Coarse, (3/4" - 3/8"); Medium, (3/8" - 3/16"); Fine, (3/16" - dust).

Physical properties of the aggregates are shown in Table I.

The cement used in this program was a Type I Portland Cement produced in the Edmonton area. Chemical composition and physical properties are shown in Table II.

An air-entraining agent is usually desirable in order to produce adequate workability in lightweight concrete without excessive mixing water. "Pozzolith" and "MBVR", commercially available products, were used for this purpose.

TABLE I

PHYSICAL CHARACTERISTICS OF AGGREGATES*

Property		Aggregate				
				Lightweight		
Gradation		Gravel	Sand	Coarse	Medium	Fine
% retained	3/4"	22.9		0.2		
	1/2"	45.7		31.1		
	3/8"	15.0	0	67.4	3.0	
	No. 4	16.6	11.1		92.6	11.2
	No. 8		10.0		2.1	25.0
	No. 16		5.4			25.8
	No. 30		6.9			9.7
	No. 50		44.4			10.9
	No. 100		18.0			8.5
	No. 200		2.5			6.5
Absorption - %		1.42	0.995	9.22	10.39	8.58
Specific Gravity (Sat. surface dry)		2.57	2.68	1.21	1.48	1.88
Unit Wt-dry rodded		98.8	102.5	43.8	45.8	70.8
F. M.			2.66			3.55
Organic Color No.			1			1

*Results of tests conducted by the author in the University of Alberta laboratories.

TABLE II

PROPERTIES OF TYPE I PORTLAND CEMENT*

Chemical Composition			
Loss on Ignition			0.80%
Silicon Dioxide (SiO_2)			21.64%
Aluminum Dioxide (AL_2O_3)			5.27%
Ferric Oxide (Fe_2O_3)			2.91%
Calcium Oxide (CaO)			63.57%
Magnesium Oxide (MgO)			3.65%
Sulphur Trioxide (SO_3)			1.90%
Physical Properties			
Fineness - Blaine (cm^2/gm)			3347
Time of Setting:	(a)	Initial	2 hr. 25 min.
	(b)	Final	4 hr. 35 min.
Compressive Strength:			
	(a)	3 days	2430 psi
	(b)	7 days	4400 psi
	(c)	28 days	6725 psi
Tensile Strength:	(a)	3 days	350 psi
	(b)	7 days	460 psi
	(c)	28 days	520 psi

*Results of analysis conducted by Inland Cement Co., Edmonton.

Mix Designs

Mixes were designed for 28 day compressive strengths of 3000, 4000 and 5000 psi for both the regular and lightweight concretes on a dry rodded volume, trial and error basis. Several mixes were designed using lightweight aggregates without air-entraining agents. Some of these mixes appeared satisfactory but had to be discarded after the testing program was instigated. All lightweight mixes investigated in this program contained air-entraining admixtures.

The mix quantities that were used in this program are shown in Tables III and IV.

TABLE III

REGULAR CONCRETE MIX QUANTITIES

Design Strength	Water	Cement	Sand*	Gravel*
3000 psi	40.5#	58.2#	144#	199#
4000 psi	40.3	68.1	135.3	199
5000 psi	40.2	81.3	124.5	199

* Oven-dry aggregate

TABLE IV

LIGHTWEIGHT CONCRETE MIX QUANTITIES

Design Strength	Water lbs.	Cement lbs.	Coarse lbs. *	Medium lbs. *	Fine lbs. *	"Pozzolith" lbs.	"MBVR" oz.
3000 psi	22.0	28.9	26.7	13.3	67.8	0.083	0.17
4000 psi	21.4	34.5	26.7	13.3	60.0	0.098	0.20
5000 psi	21.0	42.2	26.7	13.3	52.3	0.121	0.24

*Oven-dry aggregate

Notation

The following notation was used throughout the investigation:

For designed compressive strength at 28 days,

3 - 3000 psi

4 - 4000 psi

5 - 5000 psi

For type of aggregate used,

R - sand and gravel

L - lightweight expanded shale

For age of specimen at loading,

3 - 3 days

4 - 4 days

7 - 7 days

28 - 28 days

29 - 29 days.

For example, a cylinder cast from a 3000 psi mix using sand and gravel for aggregates and loaded at an age of 7 days is denoted as 3-R-7. Similarly, a cylinder marked 5-L-29 signifies it was cast from a 5000 psi mix using lightweight aggregates and was loaded at an age of 29 days.

Shrinkage specimens and standard compressive strength cylinders were marked with the same notation. For example, a beam marked 3-R would signify that it was cast from a 3000 psi mix using sand and gravel aggregates.

Curing and Test Environment

Curing conditions and test environment were identical for all test specimens. The fresh concrete was left in the molds for approximately 24 hrs. at ambient laboratory temperature. All molds were then stripped and the specimens were covered with damp burlap and left on the laboratory floor until they were three days old. At this time all specimens were stored in a special room designed to maintain a temperature of $70^{o}F$ and a relative humidity of 60%.

Compressive strength test cylinders were removed from the room on the day they were to be tested. Temperature and humidity readings were recorded during the tests so that any variations of flow and shrinkage due to temperature or humidity could be noted.

Test Specimens

The test specimens, subjected to sustained load in the loading frames, were cylinders, 48 in. long and 6 in. in diameter. Companion specimens used to determine shrinkage were 6 in. by 6 in. by 48 in. beams and these were made from the same mixes used in the test specimens. In addition to the creep and shrinkage specimens, a number of 6 X 12 in. cylinders were cast from each batch of concrete. These cylinders were used to determine the compressive strength of the concrete before the creep specimens were subjected to their sustained loads.

Apparatus for Applying Load

The sustained loads were applied to the test specimens by means of compression spring type loading frames shown in Figure I. These frames are similar to those designed and used by the Portland Cement Association in creep testing of concrete but they were modified to accommodate the compressometers. "SR-4" type wire resistant

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strain gages were affixed to each tie rod to enable the determination of the strain in each tie rod and thereby determine the stress on the concrete specimen. Calibration curves for the tie rods are included in Appendix I . A hydraulic ram was used to apply the initial load to the test specimens. Subsequent load adjustments were also made using the hydraulic ram.

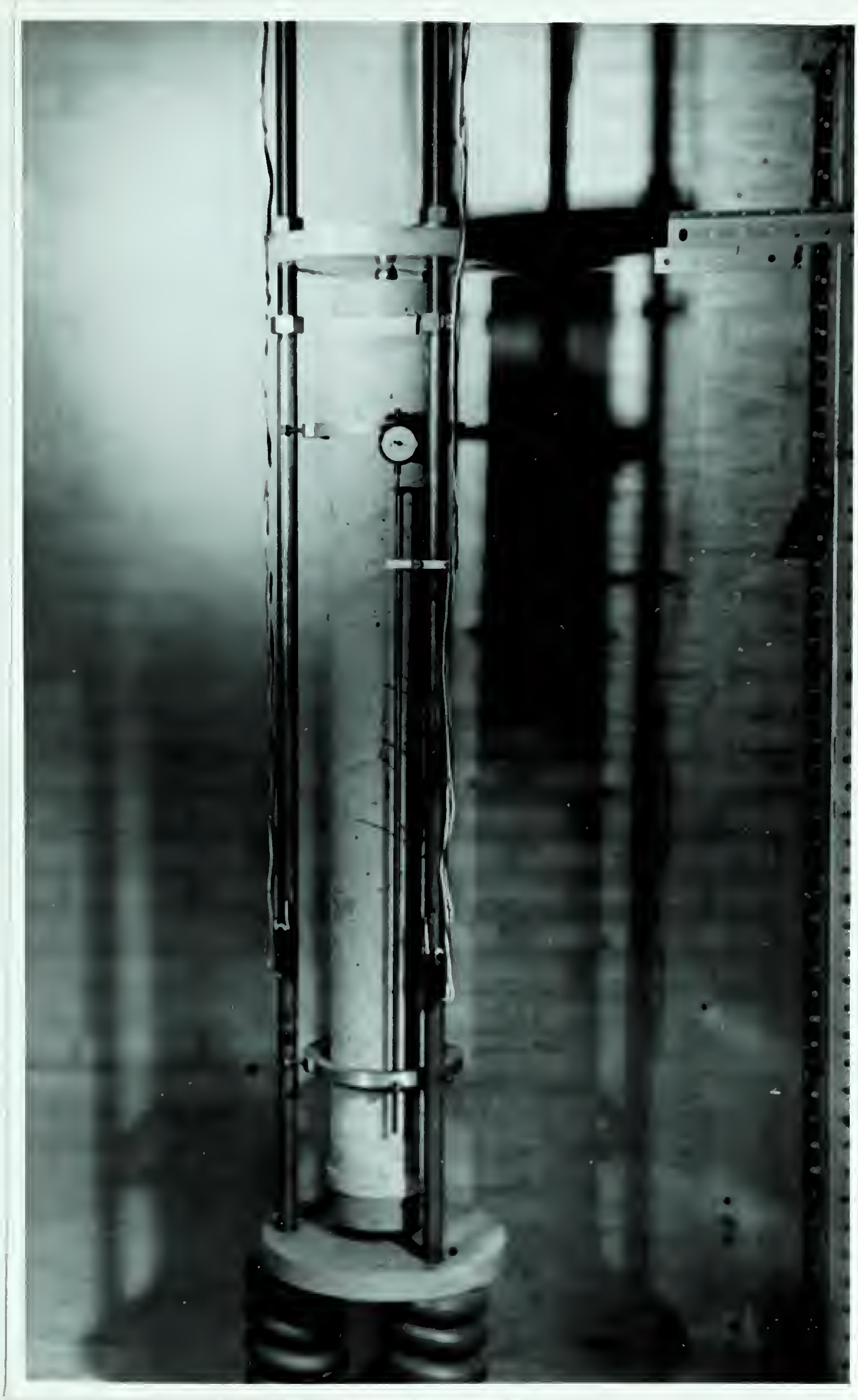
Method of Strain Measurement

The deformations of the loaded specimens--instantaneous, flow, instantaneous recovery and time-dependent recovery, were determined by means of a compressometer developed in the laboratory (Photograph 1 and Plate 2). The compressometer consisted of two rings spaced 36" apart fastened to the cylinder 6" from either end. The bottom ring was fastened rigidly to the cylinder by means of three pointed set screws placed 120° apart. The top ring was held by two horizontally opposed set screws so that the ring could rotate about an axis coincident with a diameter. An adjustable set screw was placed vertically on a pivot point at the top of a rod connected to the bottom ring. This set screw passed through the top ring and was perpendicular to the axis of rotation of the ring (Photograph 2). On the opposite side of the ring a dial gauge was attached (Photograph 3). The foot of the gauge rested on a steel plate attached to the bottom ring by means of a slender rod. This

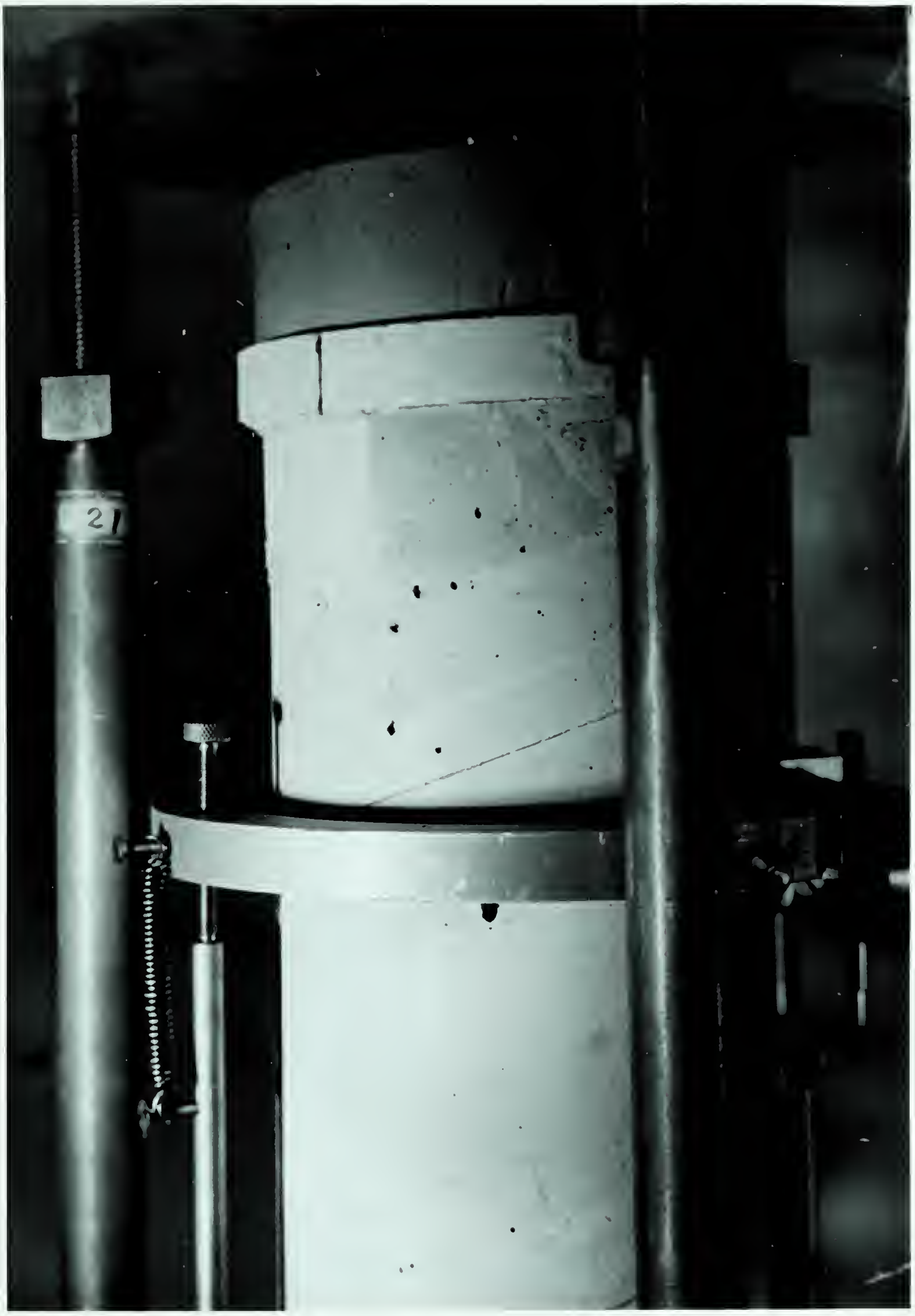
strain gages were affixed to each tie rod to ensure the determination of the strain in each tie rod and thereby determine the stress on the concrete specimen. Calibration curves for the tie rods are included in Appendix . A hydraulic ram was used to apply the initial load to the test specimens. Subsequent load adjustments were also made using the hydraulic ram.

Method of Strain Measurement

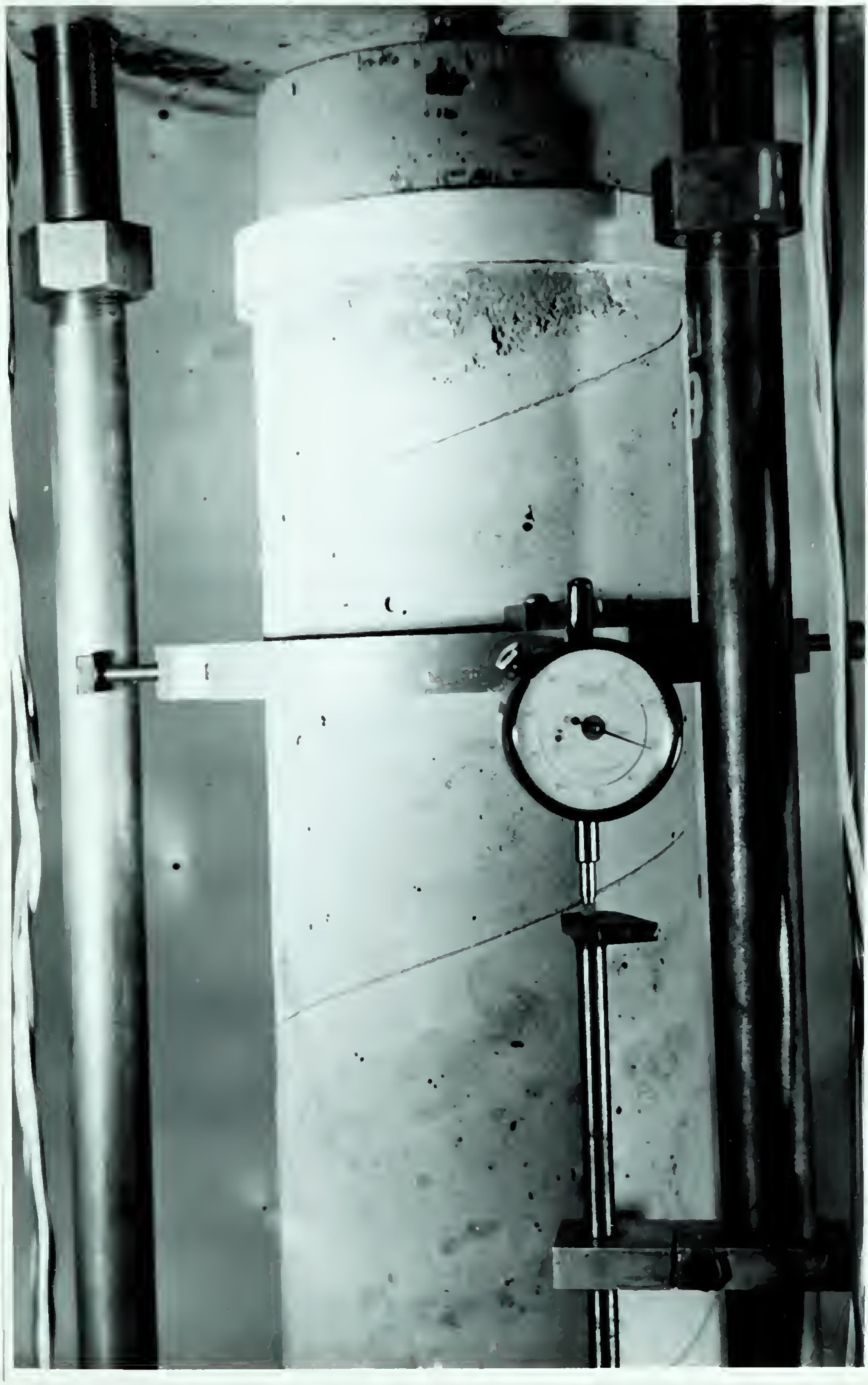
The deformations of the loaded specimens - instantaneous, flow, instantaneous recovery and time-dependent recovery, were determined by means of a compressometer developed in the laboratory (Photograph 1 and Plate). The compressometer consisted of two rings spaced 7" apart fastened to the cylinder 5" from either end. The bottom ring was fastened rigidly to the cylinder by means of three pointed set screws placed 120° apart. The top ring was held by two horizontally opposed set screws so that the ring could rotate about an axis coincident with a diameter. An adjustable set screw was placed vertically on a fixed point at the top of a rod connected to the bottom ring. This set screw passed through the top ring and was perpendicular to the axis of rotation of the ring (Photograph 2). On the opposite side of the ring a dial gauge was attached (Photograph 3). The foot of the gauge rested on a steel plate attached to the bottom ring by means of a slender rod. The



Photograph 1. Specimen, with compressometer attached, in the loading frame.



Photograph 2. Pivot point of top compressometer ring.

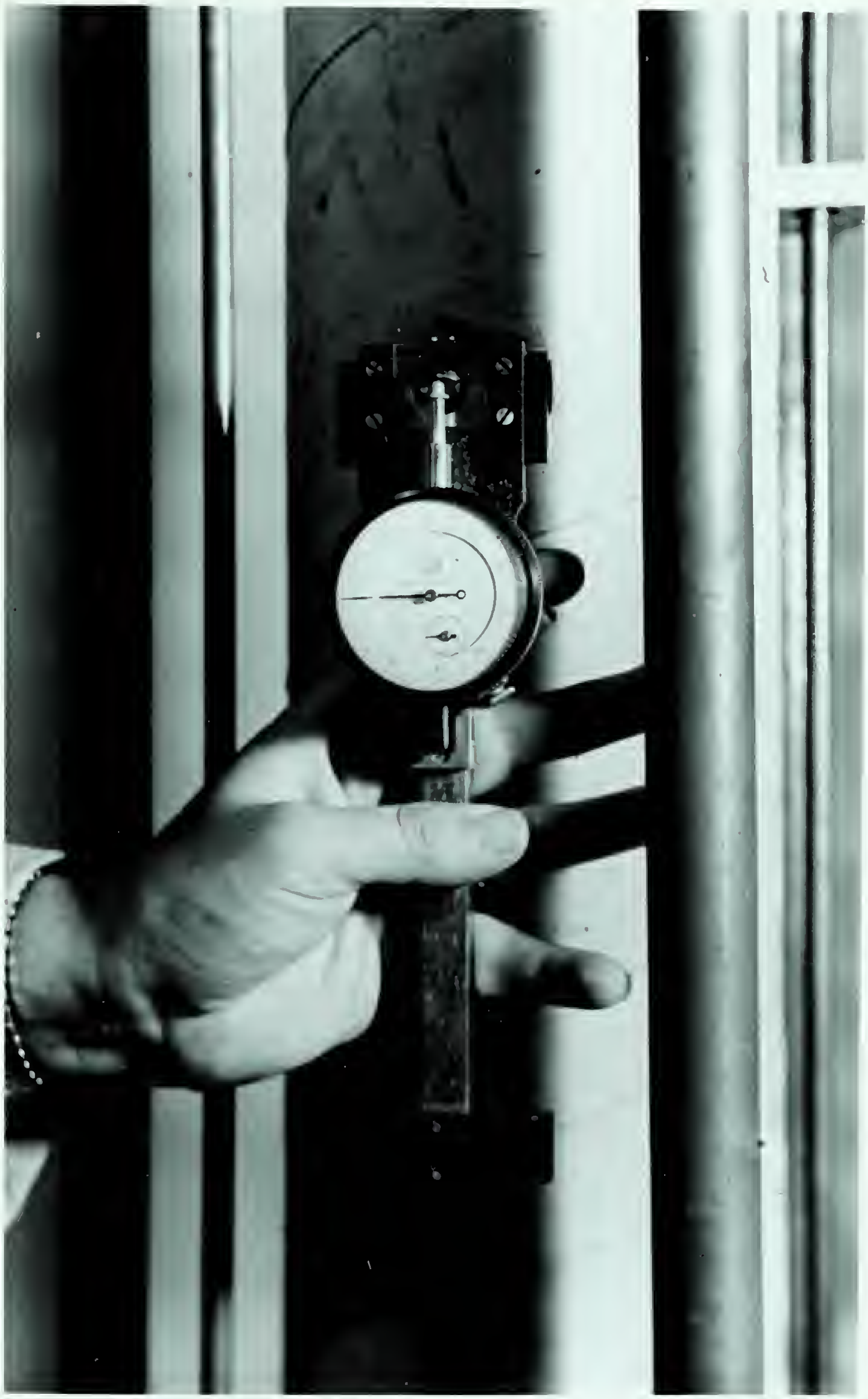


Photograph 3. Compressometer Strain Indicator.

rod was supported laterally by a clamp on one of the tie rods of the creep apparatus. As the specimen deflected, the top ring rotated about the set screw pivot point and the dial gauge indicated a movement that was equal to 2.137 times the deflection at the center of the ring.

A compressometer factor of 0.013 was determined for converting differences indicated by the dial gauge of the compressometer to changes in unit strain occuring in the test specimen. This factor was obtained in the following manner. Four "SR 4" type wire resistant strain gages were symmetrically placed on the circumference of a hollow steel cylinder. A compressometer was attached to this cylinder and the entire unit was placed in a hydraulic testing machine. A compressive load was applied to the cylinder in predetermined increments and simultaneous readings of strain as indicated by the "SR-4" gages and the compressometer were recorded. Curves were plotted of load versus indicated strain and the compressometer factor determined.

Gauge points consisting of mild steel rods and stainless steel screws were cast in all specimens along two longitudinally placed gauge lines. Observations of changes in length of the loaded as well as the unloaded specimens were made by use of an 8 inch "Demec" mechanical strain gauge to determine shrinkage and to check the compressometer readings (Photograph 4).



Photograph 4. Demec Strain Gauge.

CHAPTER V

TEST PROCEDURE

Using a process of trial and error the following procedure evolved and was followed in this investigation.

<u>Preparation of Aggregates</u>

All aggregates used in this investigation were oven-dried at a temperature of 110^{o}C to a constant unit weight before batching. The gravel was divided, using aggregate sieves, into its various component sizes. These fractions were recombined to form uniform samples conforming to the analysis shown in Table I. The lightweight aggregates were received in three size ranges - 3/4" to 3/8", 3/8" to 3/16" and 3/16" to dust. A relatively constant gradation resulted from a given combination of the three size ranges so no attempt was made to adjust the gradation.

After oven-drying, the sand and gravel were weighed and combined in batch proportions. The combined aggregate was stored in canvas bags until the time of mixing. The lightweight aggregates were also weighed and combined in batch proportions after oven-drying but were stored in plastic bags. Twenty-four hours before batching one half of the mixing water to be used in the batch was

CHAPTER V

TEST PROCEDURE

Where the effects of heat and water the following procedure was developed and was followed in this investigation.

Preparation of Aggregates

All aggregates used in this investigation were oven dried at a temperature of 110°C to a constant unit weight before batching. The gravel was divided, using appropriate sieves, into its various component sizes. These fractions were recombined to form uniform samples conforming to the Analysis shown in Table I. The lightweight aggregates were received in three size ranges - 3/4" to 3/8", 3/8" to 3/16" and 3/16" to dust. A relatively constant gradation resulted from a given combination of the three size ranges so no attempt was made to adjust the gradation.

After oven-drying, the sand and gravel were weighed and combined in batch proportions. The combined aggregate was stored in canvas bags until the time of mixing. The lightweight aggregates were also weighed and combined in batch proportions after oven-drying but were stored in plastic bags. Twenty-four hours before batching one half of the mixing water to be used in the batch was

added to the lightweight aggregate. This was done to reduce the absorption of water by the aggregate during mixing.

Mixing Techniques

The natural aggregate concrete was mixed in a rotary tilting-drum, three and a half cubic foot capacity mixer. The sand, gravel and cement were placed in the mixer and mixed for one minute. The water was then added and mixing continued for three minutes.

The mixes using lightweight aggregates were mixed in a two cubic foot Lancaster paddle type mixer. The lightweight aggregates and the remainder of the water were placed in the mixer and allowed to mix for one minute. The cement and admixtures were added and mixing continued for an additional three minutes.

Molds and Casting Procedures

The 6 in. by 6 in. by 48 in. beams that were used to determine shrinkage were cast in wooden molds that had been waterproofed and well oiled. The 6 in. diameter creep cylinders were cast in a heavy-wall paper tube lined with polythene plastic. These tubes are sold commercially under the trade name of "Sonotubes". The bottom end of the "Sonotube" was plugged with one of the 2 in. thick steel plates from the loading rigs.

Gauge points were placed in the molds at predrilled locations. Stainless steel screws were used in the shrinkage molds (Plate 3) and 9/16 in. diameter steel rods were used in the "Sonotubes".

The shrinkage beams, for the regular concrete, were poured in two layers, each layer being tamped 150 times with a 5/8 in. diameter standard steel tamping rod. The creep cylinders were filled in five layers, each layer being tamped 50 times with a standard shaped steel rod.

All lightweight concrete was placed with the aid of a $1\frac{1}{2}$ in. diameter electrically driven vibrator. Beams were filled in two layers and creep cylinder molds in five layers. The concrete was well vibrated to obtain dense specimens.

Standard 6 in. by 12 in. cylinders were taken from each batch of concrete poured. Cylinders composed of regular concrete were made according to standard ASTM procedures but cylinders of lightweight concrete were made by filling the molds in three equal layers and vibrating each layer with the vibrator used to compact the other lightweight specimens.

Capping and Loading Procedures

When the specimens were three days old they were moved from the laboratory to a special room where the temperature was maintained

at approximately 70°F. The relative humidity in the room varied from 50 to 70 per cent producing an average relative humidity of 60 per cent.

The steel gauge bars in the flow specimens were marked and drilled with a No. 60 drill to provide gauge seats for the "Demec" gauge. Following this procedure the specimens to be loaded at this age were capped with a sulphur-clay mixture to ensure plane and parallel ends. Compressive strength cylinders were also capped and broken, and the ultimate loads recorded.

The cylinders that were to be subjected to sustained loads were placed in the loading frames and the compressometers attached. Initial readings of the distances between the gauge points were determined with the "Demec" gauge. Initial strain readings of all the "SR-4" gages attached to the loading frame tie-rods were observed and recorded.

The load to be applied to each cylinder was computed by multiplying the ultimate load carried by the respective 6 X 12 cylinders by 0.45, i.e. each test cylinder was loaded to the commonly accepted design percentage of its ultimate strength. This load was divided by three and the average increase in strain to be expected in the "SR-4" gages was determined from the tie rod calibration curves. This increase was added to the initial gauge readings to obtain the final gauge

at approximately 70%. The relative humidity in the room varied from 40 to 70 per cent producing an average relative humidity of 55 per cent.

The steel gauge bars in the flow specimens were center-punched and drilled with a No. 60 drill to provide gauge holes for the Whittemore gauge. Following this procedure the specimens to be loaded in the age were capped with a sulphur-clay mixture to ensure plane and parallel ends. Compressive strength cylinders were also capped and broken, and the ultimate loads recorded.

The cylinders that were to be subjected to sustained loads were placed in the loading frames and the compressometers attached. Initial readings of the distance between the gauge points were determined with the Whittemore gauge. Initial strain readings on all the SR-4 gages attached to the loading frame tie-rods were observed and recorded.

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readings that could be expected when the desired load was placed on the specimen. A hydraulic ram was placed in position between the top end plates and a zero reading of the compressometer was obtained. Load was applied to the specimen by the ram until the desired stress condition was obtained in the sample as indicated by the "SR-4" gage readings. Locking nuts were moved into position and the ram was removed. "SR-4" gage readings were observed and recorded and the load on the specimen was computed. Compressometer and "Demec" readings were obtained and recorded as soon as the locking nuts were moved into position. These readings were used as zero readings for subsequent flow measurements.

When the concrete cylinders were seven days old one cylinder from each design mix was subjected to a sustained load following the procedure previously explained. The remaining cylinders were loaded at ages of 28 or 29 days after casting.

The strain in the tie-rods was checked periodically and the load on the specimen was adjusted to its original value to ensure a relatively constant stress condition. The load on the specimen, before and after load adjustment, as determined from the "SR-4" gage readings was recorded. Any deformation occurring in the sample during load adjustment was also observed and recorded. At the termination of

the testing program all samples were unloaded and the instantaneous recovery, as well as any subsequent time-dependent recovery, was determined and recorded.

<u>Measurements and Treatment of Data</u>

Measurements were made of the strains that occurred in all samples. These measurements were recorded and are shown in Appendix II . For the cylinders subjected to sustained loads, strains were measured over a 36 inch length, with a compressometer. Strains were also measured over four 8 inch gauge lengths using the "Demec" gauge. For the unloaded companion beams, strain was determined over six 8 inch gauge lengths using the "Demec" gauge. All strain measurements were reduced to a unit strain basis to facilitate comparison between the various specimens.

The instantaneous unit deformation that occurred in each sample that was loaded was determined by subtracting the initial reading of the compressometer before loading from the compressometer reading obtained immediately after loading was completed and multiplying this difference by the compressometer factor of 0.013.

The unit flow after any period of time was determined by subtracting the compressometer reading obtained after loading from the compressometer reading obtained at the end of the time period and

multiplying this difference by the compressometer factor. Unit flow was also computed from measurements taken with the "Demec" gauge. "Demec" gauge readings recorded immediately after the load had been applied to the cylinder were subtracted from subsequent readings. These differences were multiplied by the gauge factor 0.098 to obtain the unit flow that had occurred.

Shrinkage measurements on the concrete beams consisted of determining the average change, over any time period, between the initial and subsequent "Demec" readings obtained over the six gauge lengths. Unit shrinkage was determined by multiplying the average change by the "Demec" gauge factor. The initial readings for the shrinkage specimens were recorded 3 days after casting. Shrinkage measurements were also recorded for the cylinders scheduled for loading at an age of 29 days. A comparison of shrinkage readings for the beams and columns is shown in Plate XI.

The instantaneous unit recovery that occurred in the specimens when the sustained load was removed was determined in the following manner: The compressometer reading observed immediately after unloading was subtracted from the compressometer reading obtained just prior to unloading. The difference was multiplied by the compressometer factor to obtain unit recovery. The reading recorded

after unloading was used as the initial reading for subsequent time-recovery determinations.

Temperature and relative humidity were recorded daily. Temperature fluctuated between 68 and $72^{o}F$ and relative humidity fluctuated between 44 and 100 percent. The temperature and relative humidity records are included in Appendix II .

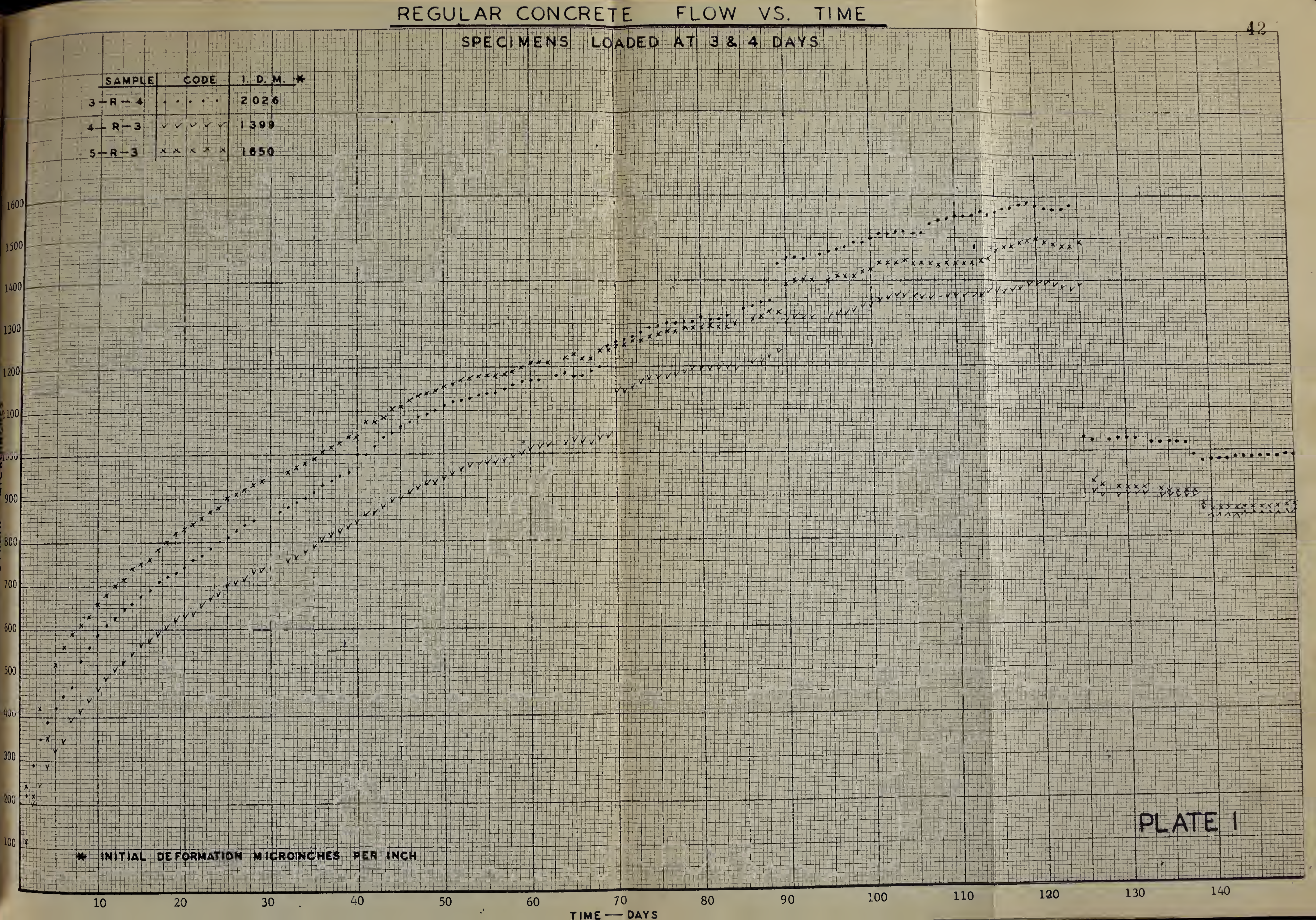
CHAPTER VI

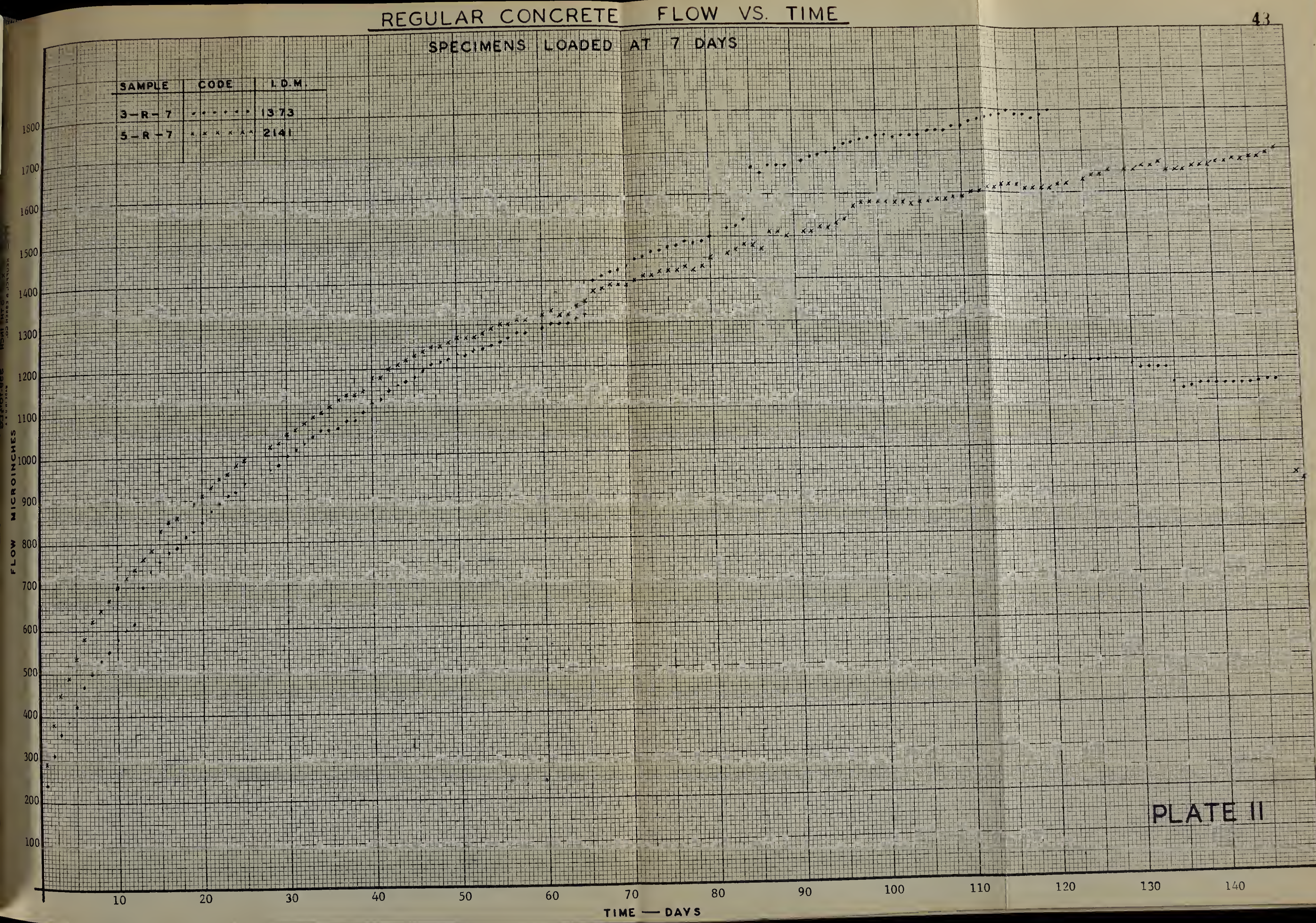
TEST RESULTS AND DISCUSSION

Results of Tests

Results of the experimental investigation on the deformation of concrete under a sustained load are summarized in Table V. Behavior of the test cylinders under load is illustrated by the flow-time curves shown in Plates I to VI inclusive. The behavior of the unloaded beams is illustrated by the shrinkage-time curves shown in Plates VII to X. A comparison of the behavior of unloaded concrete cylinders and the concrete beams is shown by the shrinkage-time curves in Plate XI. At the end of the test program the data obtained were reduced to a unit strain basis and strain-time curves were plotted.

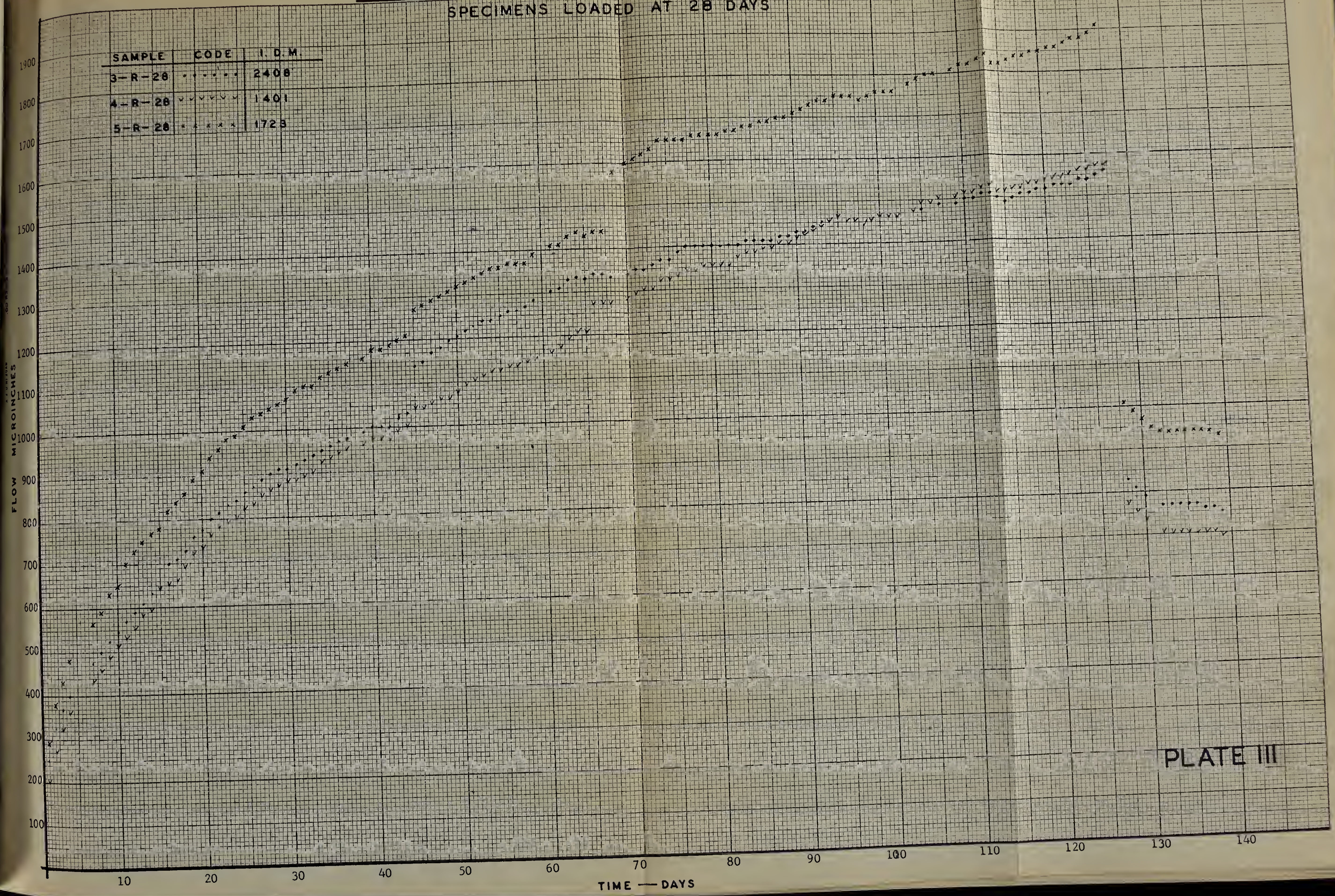
Attention is drawn to the large vertical displacements that occur in the flow-time curves. As the cylinder deformed under the sustained load, the magnitude of the sustained load decreased. It was necessary, therefore, to periodically adjust the load on the test cylinder to its original value. Each time the load was adjusted the cylinder exhibited a relatively large deformation. These deformations, which are probably of an elastic nature, caused the flow-time curves to indicate large instantaneous strains.


REGULAR CONCRETE FLOW VS. TIME
SPECIMENS LOADED AT 3 & 4 DAYS
SAMPLE | CODE | I. D. M. *
3-R-4 | · · · · · | 2026
4-R-3 | ✓ ✓ ✓ ✓ ✓ | 1399
5-R-3 | × × × × × | 1650
STRAIN MICROINCHES
TIME — DAYS
* INITIAL DEFORMATION MICROINCHES PER INCH
PLATE I

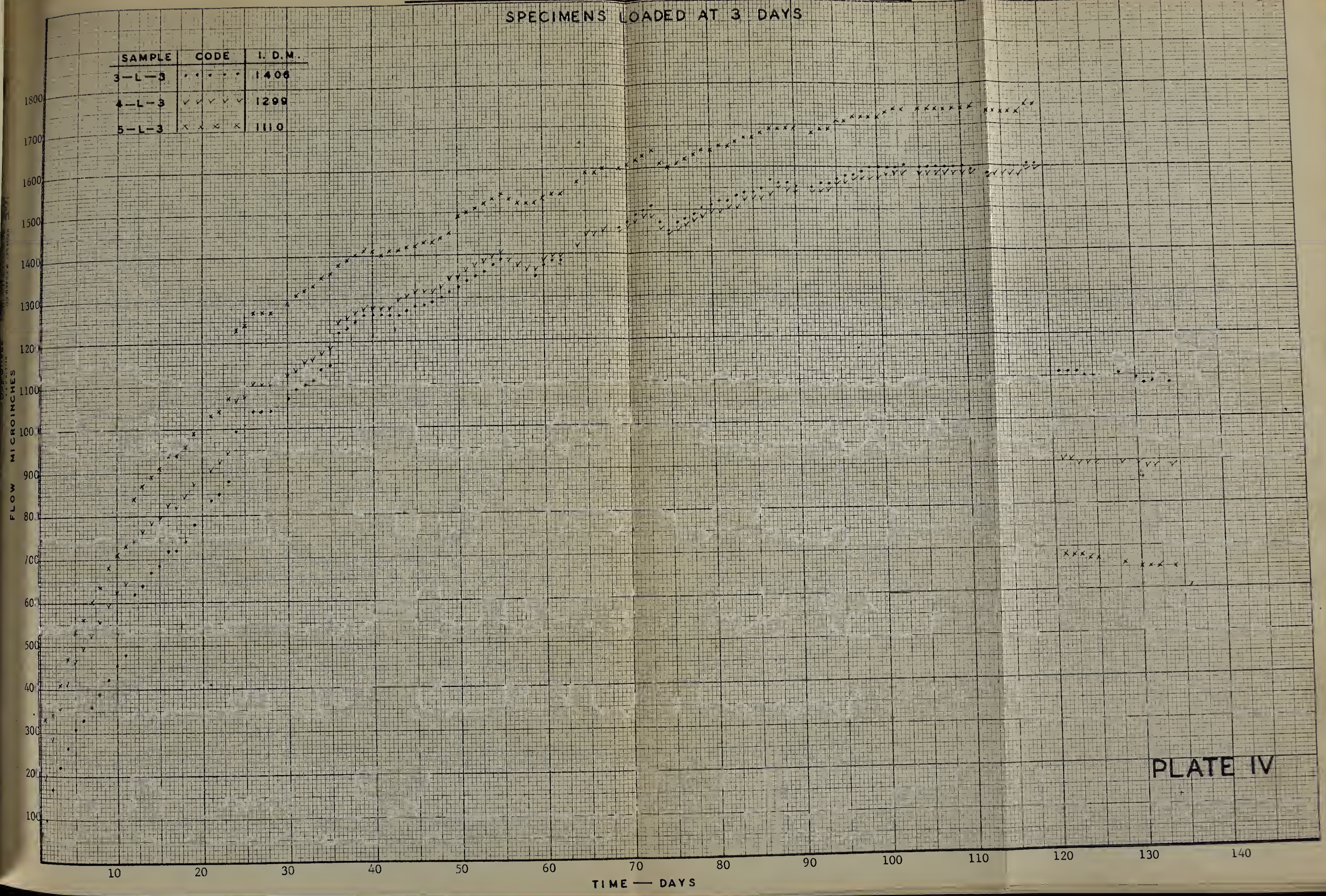


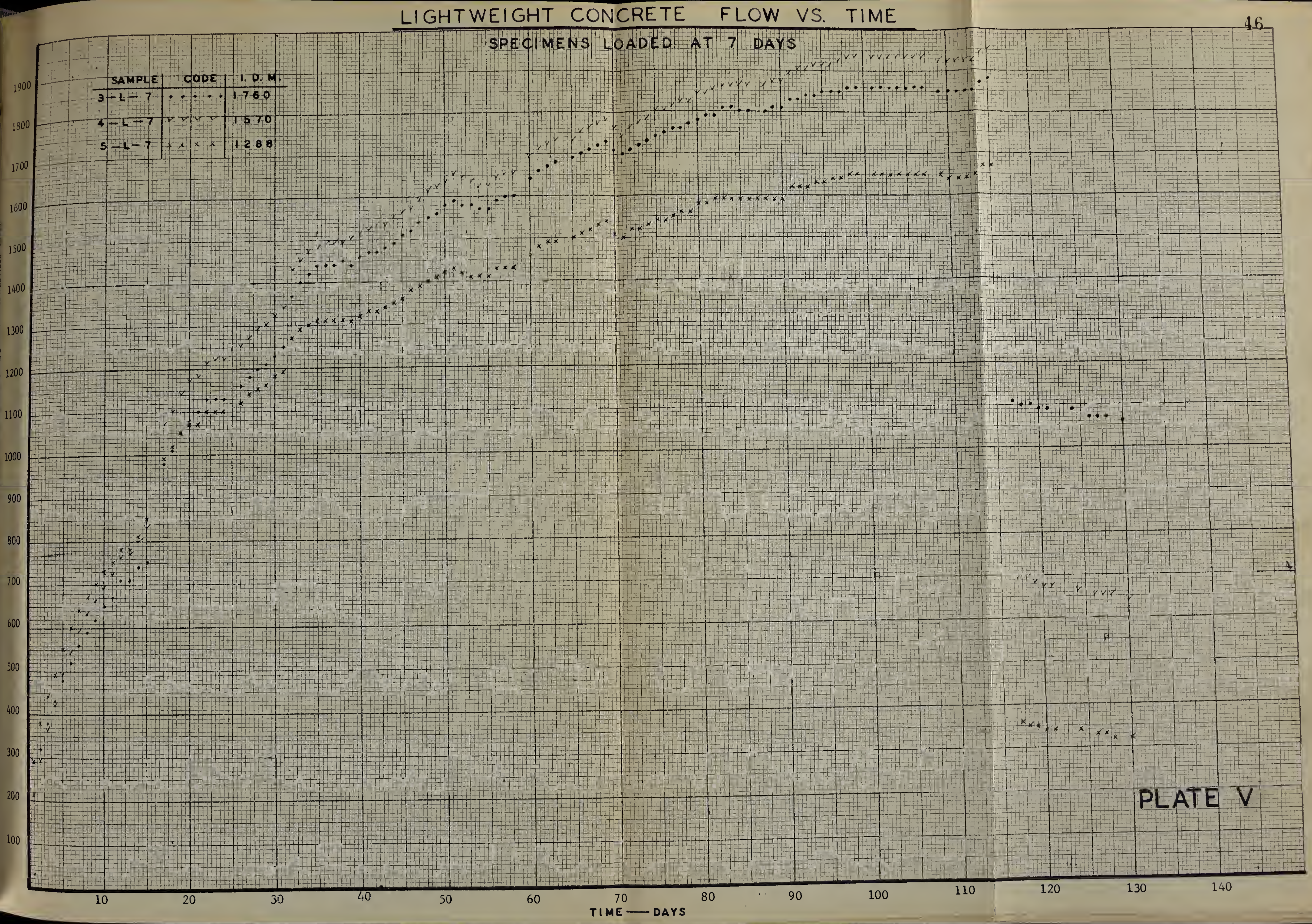
REGULAR CONCRETE FLOW VS. TIME
SPECIMENS LOADED AT 7 DAYS
SAMPLE
CODE
I.D.M.
3-R-7
1373
5-R-7
2141
FLOW MICROINCHES
TIME — DAYS
PLATE II

REGULAR CONCRETE FLOW VS. TIME



LIGHTWEIGHT CONCRETE FLOW VS. TIME




LIGHTWEIGHT CONCRETE FLOW VS. TIME
SPECIMENS LOADED AT 7 DAYS
SAMPLE | CODE | I. D. M.
3-L-7 | • • • • • | 1760
4-L-7 | v v v v v | 1570
5-L-7 | x x x x | 1288
FLOW — MICROINCHES
TIME — DAYS
PLATE V

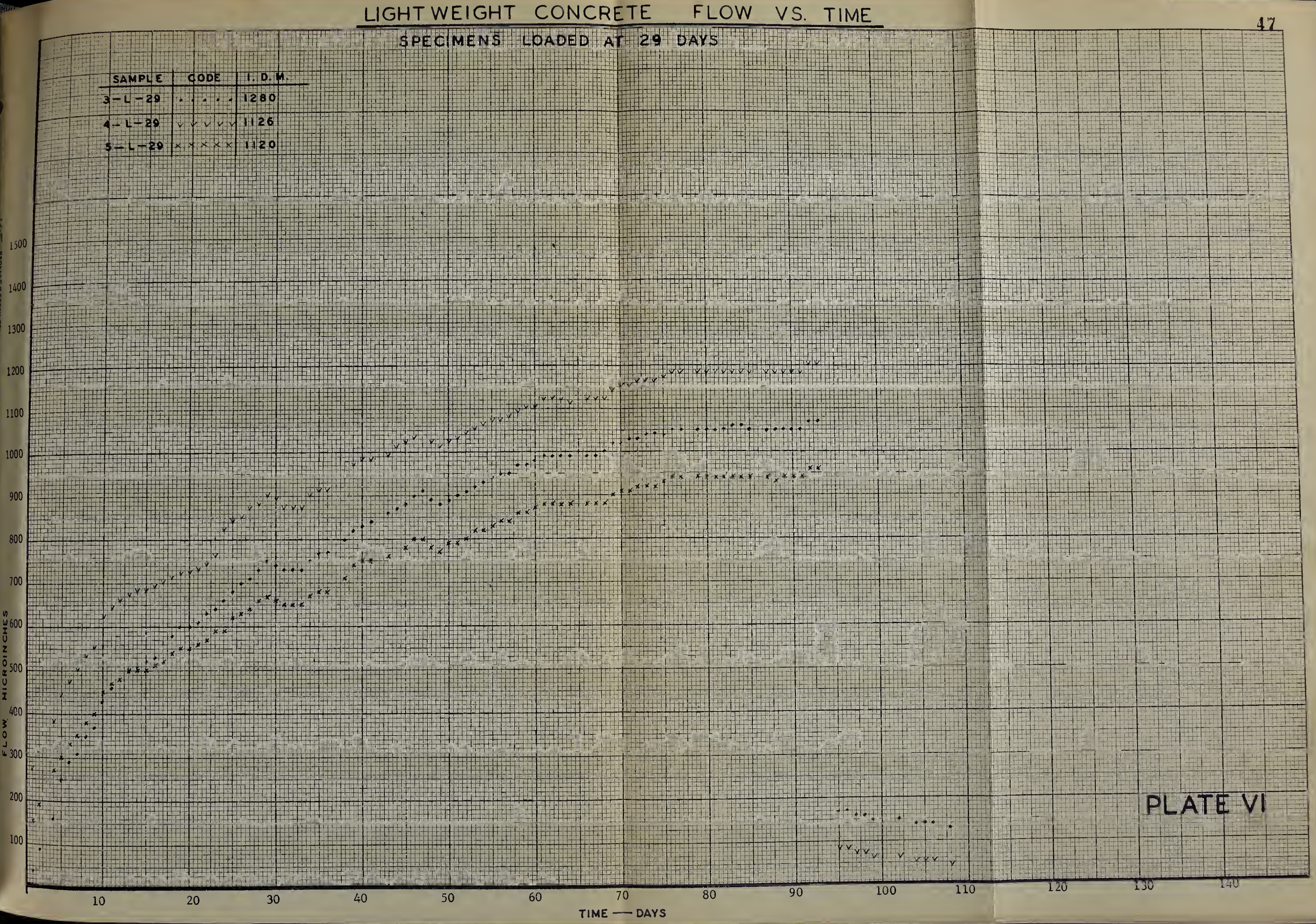

LIGHTWEIGHT CONCRETE FLOW VS. TIME
SPECIMENS LOADED AT 29 DAYS
SAMPLE | CODE | I. D. M.
3-L-29 | . . . . . | 1280
4-L-29 | v v v v v | 1126
5-L-29 | x x x x x | 1120
FLOW MICROINCHES
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME — DAYS
10
20
30
40
50
60
70
80
90
100
110
120
130
140

PLATE VI

REGULAR CONCRETE SHRINKAGE VS. TIME

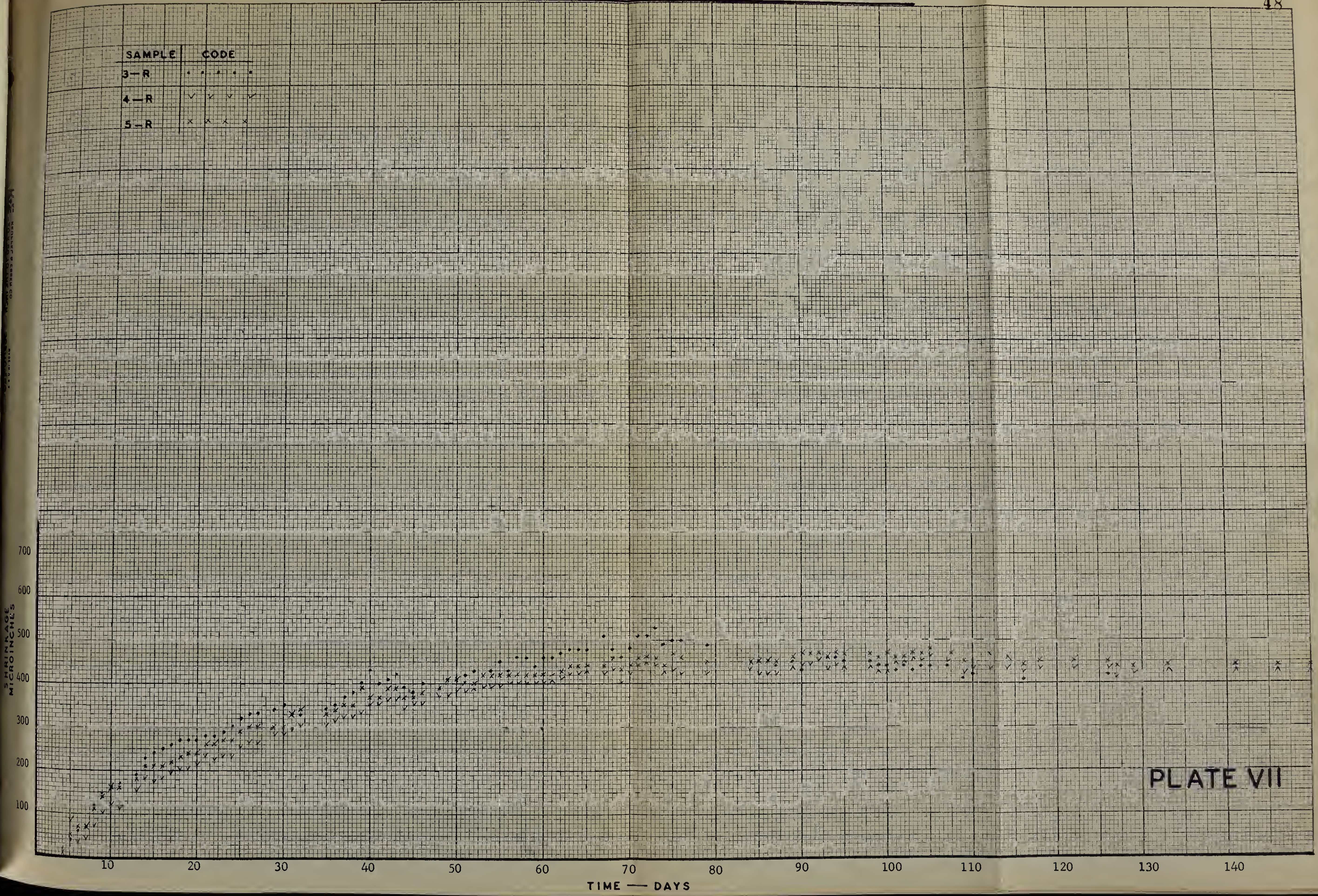
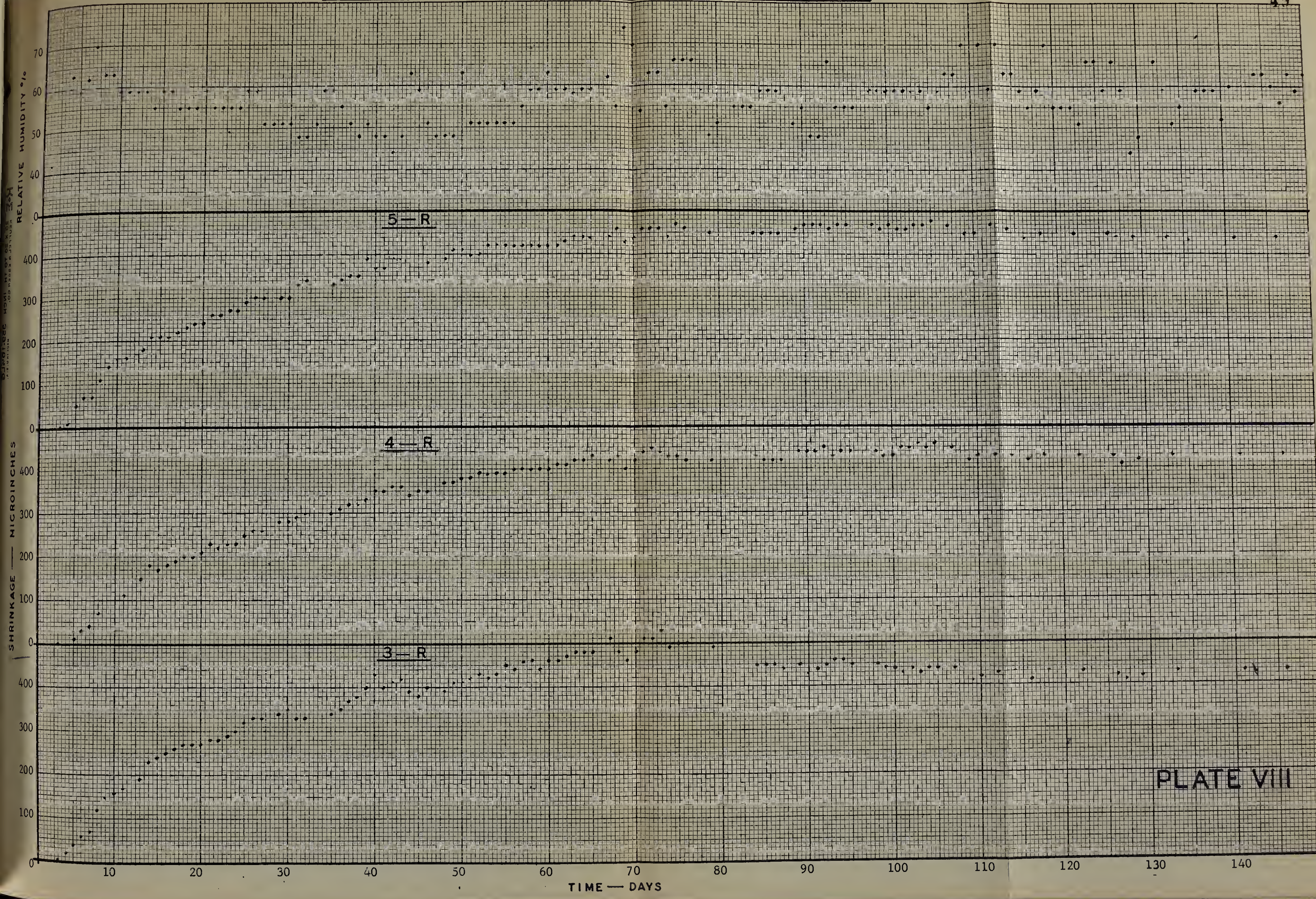


PLATE VII

REGULAR CONCRETE SHRINKAGE VS. TIME



LIGHTWEIGHT CONCRETE SHRINKAGE VS. TIME

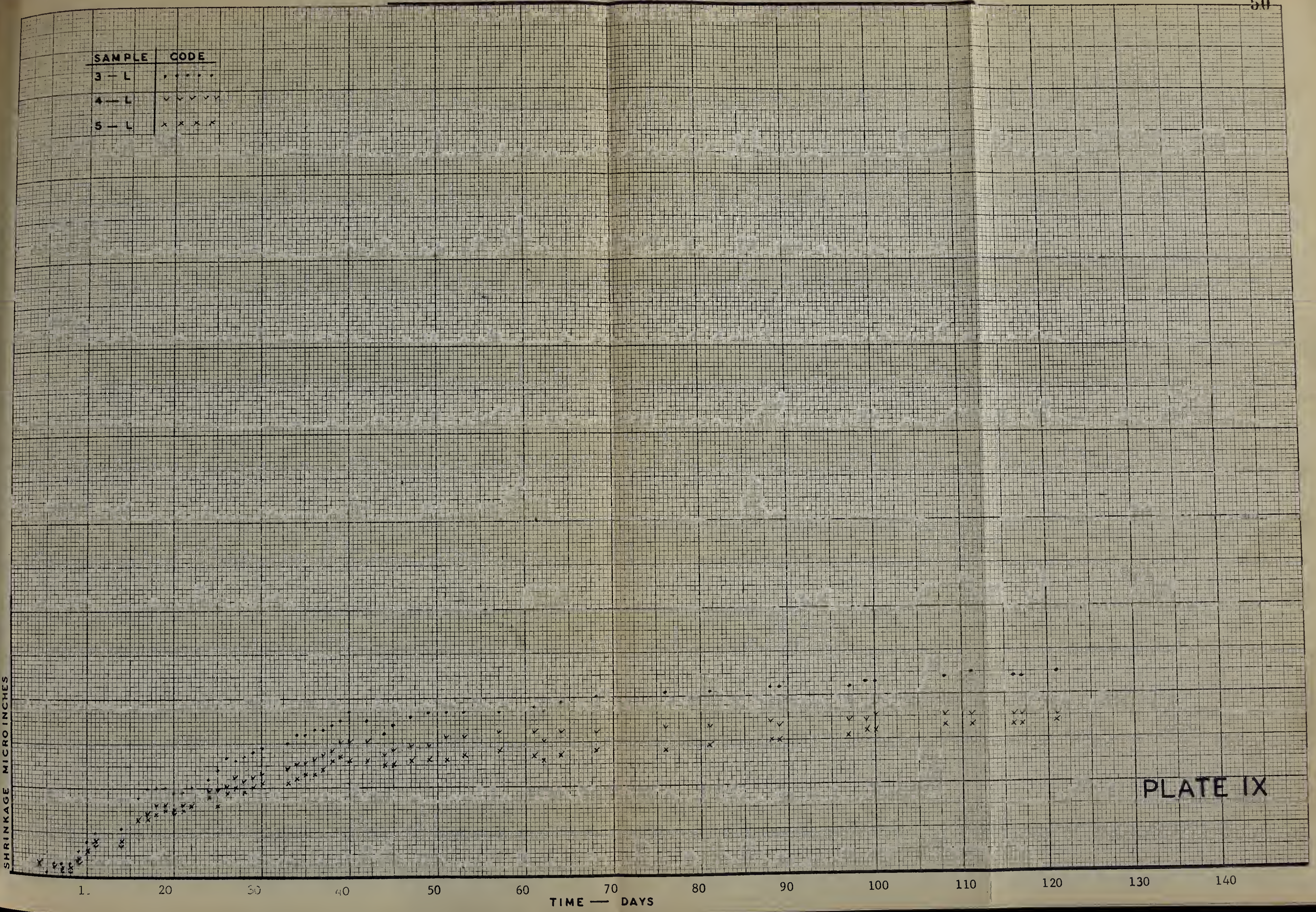


PLATE IX

LIGHTWEIGHT CONCRETE SHRINKAGE VS. TIME

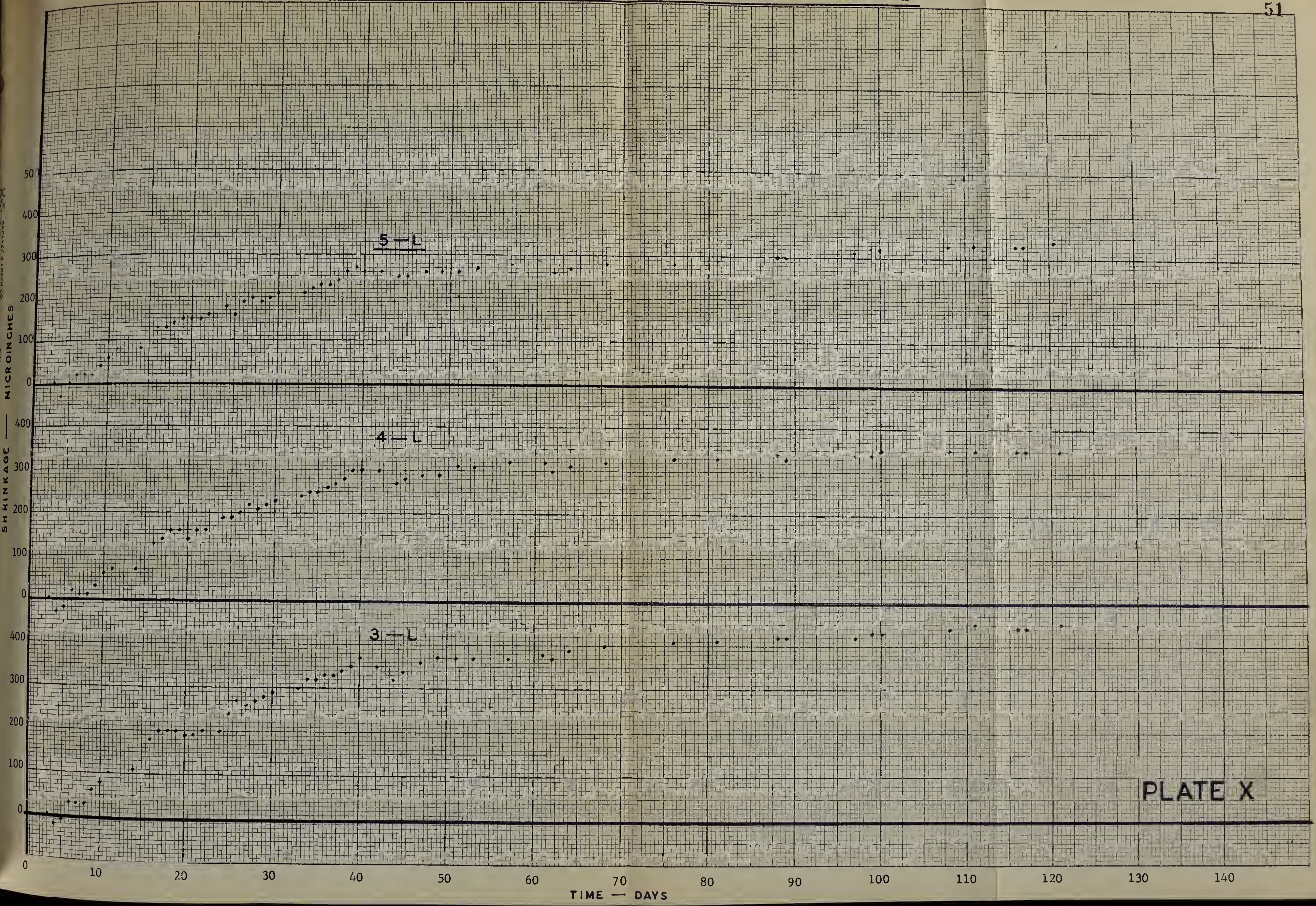


PLATE X

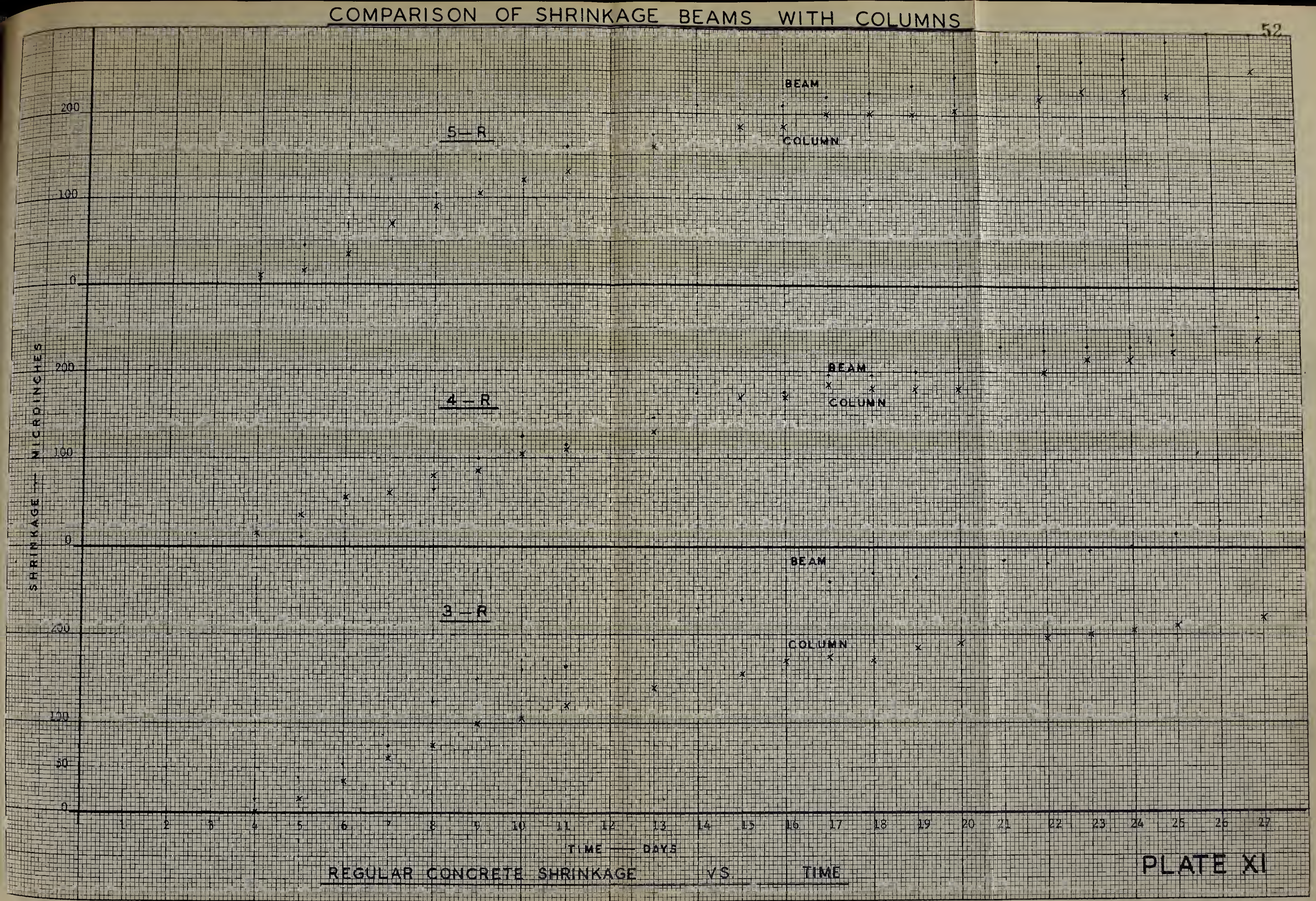

COMPARISON OF SHRINKAGE BEAMS WITH COLUMNS
5—R
BEAM
COLUMN
4—R
BEAM
COLUMN
3—R
BEAM
COLUMN
SHRINKAGE — MICROINCHES
TIME — DAYS
REGULAR CONCRETE SHRINKAGE VS. TIME

PLATE XI

TABLE V

SUMMARY OF EXPERIMENTAL RESULTS

Sample No.	f'_c psi (1)*	Applied Stress psi (2)*	% f'_c (3)*	Initial Strain "/" X 10^6 (4)*	Max. Flow "/" X 10^6 (5)*	Initial Rec. "/" X 10^6 (6)*	E X 10^6 (7)*	% Rec. (8)*	Time under Load Days (9)*
3-R-4	1816	874	48.1	2026	1581	436	0.43	12.1	124
4-R-3	2026	900	44.4	1399	1385	448	0.64	16.1	125
5-R-3	3191	1522	47.7	1650	1492	494	0.92	15.7	125
3-R-7	2778	1185	42.7	1373	1795	491	0.86	15.5	121
5-R-7	4777	2247	47.0	2141	1699	688	1.05	17.9	148
3-R-28	4069	1831	45.0	2408	1555	660	0.76	16.6	127
4-R-28	5087	2289	45.0	1401	1573	705	1.63	23.7	127
5-R-28	5909	2659	45.0	1723	1913	789	1.48	22.0	127
3-L-3	1008	455	45.1	1406	1606	325	0.32	10.8	119
4-L-3	2120	961	45.3	1299	1592	632	0.74	21.9	119
5-L-3	3585	1663	46.4	1110	1750	966	1.50	33.8	119
3-L-7	1699	782	46.0	1760	1875	687	0.44	18.9	115
4-L-7	3645	1656	45.4	1570	1949	1152	1.05	32.8	115
5-L-7	4728	2159	45.7	1288	1668	1327	1.68	44.9	115
3-L-29	2481	1155	46.6	1280	1073	815	0.9	34.7	93
4-L-29	4023	1805	44.9	1126	1202	1010	1.5	43.4	93
5-L-29	5343	2389	44.7	1120	960	1000	2.14	48.1	93

*

(1) Compressive strength determined from 6" x 12" cylinders
(2) Initial stress computed from "SR-4" strain gauge readings
(3) Sustained stress divided by compressive strength
(4) Unit deformation during loading as determined from compressometer readings
(5) Maximum flow determined from compressometer readings
(6) Initial recovery on unloading determined by the compressometer
(7) Column (2) divided by column (4)
(8) Column (6) divided by the sum of columns (4) and (5).

Flow-time curves and shrinkage-time curves are usually combined to obtain creep-time curves. The value for creep is obtained by subtracting the shrinkage value from the flow value for compatible specimens. Plate XI shows a comparison of the shrinkage that occurred in the shrinkage beams and the shrinkage that occurred in the cylinders scheduled for loading at an age of 28 days. The magnitude of shrinkage at any time is quite different for the two specimens because of the difference in surface areas. Because of this difference no attempt was made to evaluate the amount of creep that occurred in the loaded specimens by combining the flow-time and shrinkage-time curves.

Discussion of Results

The effect of the following variables on the flow of concrete was investigated: water-cement ratio, type of aggregate, and age at time of loading. Flow of concrete is composed of shrinkage and creep, therefore, all statements made with regard to the creep of concrete may be shown to be applicable to the flow of concrete under comparable conditions.

(a) Water-cement ratio. Most investigators claim that as the water-cement ratio decreases the amount of creep in the concrete will also decrease. It may be observed by studying the flow-time curves (Plates I to VI) that there is no constant relationship between the

Flow-time curves and shrinkage-time curves are usually combined to obtain creep-time curves. The value for creep is obtained by subtracting the shrinkage value from the flow value for corresponding specimens. Plate II shows a comparison of the shrinkage that occurred in the shrinkage beams and the shrinkage that occurred in the cylinders scheduled for loading at an age of 28 days. The magnitude of shrinkage at any time is quite different for the two specimens because of the difference in surface areas. Because of this difference no attempt was made to evaluate the amount of creep that occurred in the loaded specimens by combining the flow-time and shrinkage-time curves.

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(a) Water-cement ratio. Most investigators claim that as the water-cement ratio decreases the amount of creep in the concrete will also decrease. It may be observed by studying the flow-time curves (Plates I to VI) that there is no constant relationship between the

magnitude of flow and the design strength of the concrete. Lightweight cylinders cast from the 4000 psi design mix exhibit the greatest amount of flow of all lightweight cylinders subjected to load at ages of 3 and 29 days and the cylinder cast from the 5000 psi design mix exhibited the greatest amount of flow of all lightweight cylinders loaded at 7 days. Natural aggregate cylinders cast from the 3000 psi design mix exhibit the greatest amount of flow of all natural aggregate cylinders subjected to loads at ages of 3 and 7 days. The cylinder cast from the 5000 psi design mix exhibits the greatest flow of those loaded at an age of 28 days.

Table VI shows the magnitude of total unit strain (instantaneous) plus flow) that occurred in each sample after 100 days of sustained loading. The lightweight concrete results show that the magnitude of strain decreases as the design strength increases. These results are compatible with current opinion. The natural aggregate concrete results do not indicate a consistent relationship between total strain and design strength.

The discrepancy in the order of magnitude of total strain measured for each type of concrete may be due to the different methods used in compacting the concrete. The natural aggregate concrete was placed in five equal layers with each layer being rodded 50 times with

a 5/8" diameter steel rod. The lightweight concrete was also placed in five equal layers but each layer was thoroughly compacted using an internal vibrator. Non-uniform rodding in the compaction of the natural aggregate concrete could result in varying degrees of density which could possibly account for the inconsistent relationship between total unit strain (instantaneous plus flow) and design strength indicated in Table VI.

TABLE VI

MAGNITUDE OF STRAIN AFTER 100 DAYS OF SUSTAINED LOAD
MICROINCHES PER INCH

Age at loading days	DESIGN MIXES					
	3R	4R	5R	3L	4L	5L
3	-	2769	3090	3006	2869	2830
4	3526	-	-	-	-	-
7	3113	-	3731	3690	3500	2938
28	3868	2861	3483	-	-	-
29	-	-	-	2350	2326	2080

(b) Type of aggregate. Test results have shown that under comparable conditions, concretes containing different aggregates exhibit different amounts of creep. Jones and Hirsch(16) show that the

creep of concretes containing lightweight aggregates is generally greater than for concretes containing natural aggregates. Best and Polivka(3) show that creep in lightweight concrete is essentially equal to or less than that in regular concrete of comparable strength. The results reported herein indicate that the total strain (instantaneous plus flow) of the lightweight concrete is generally less than the corresponding strain in the natural aggregate concrete when the two concretes have comparable strengths (Table V).

(c) Age at time of loading. The greater the degree of hydration of the cement in a concrete member at the time of load application, the lower the rate and total amounts of creep. The flow-time curves indicate results that do not conform with current opinion. In general the cylinders loaded at an age of 7 days exhibited more flow than the cylinders loaded at 3 days. The majority of cylinders loaded at 28 or 29 days, however, exhibited less flow than the cylinders loaded at 3 days.

The shrinkage-time curves (Plates VII to X) show that the magnitude of shrinkage for a concrete containing a specific aggregate will be relatively the same at any time regardless of the strength of the concrete.

creep of concretes containing lightweight aggregates is generally greater than for concretes containing natural aggregates. [illegible](9) found that creep in lightweight concrete is essentially equal to or less than that in regular concrete of comparable strength. The results reported herein indicate that the total strain (instantaneous plus flow) of the lightweight concrete is generally less than the corresponding strain in the natural aggregate concretes when the two concretes have comparable strengths (Table [illegible]).

(c) Age at time of loading. The greater the degree of hydration of the cement in a concrete specimen at the time of load application, the lower the rate and total amounts of creep. The flow-time curves indicate results that do not conform with accepted theories. In general the cylinders loaded at an age of 7 days exhibited less flow than the cylinders loaded at 3 days. The majority of cylinders loaded at 14 or 28 days, however, exhibited less flow than the cylinders loaded at 7 days.

The deformation-time curves (Figures [illegible] to [illegible]) show that the magnitude of shrinkage for a concrete containing a specific aggregate will be relatively the same at any time regardless of the strength of the concrete.

To summarize, results obtained indicate that for expanded-shale concretes the total strain (instantaneous plus flow) as well as shrinkage is of the same order of magnitude as for concretes of comparable strengths containing natural aggregates. The results do not clearly indicate the effect of the water-cement ratio or the age at time of loading on the magnitude of flow.

Performance of Test Equipment

The loading frames were satisfactory for maintaining the desired load on the specimens, however the "SR-4" strain gages used to determine the stress in the tie rods appeared to be unstable under sustained loads. As the test cylinder deformed under the load the stress maintained by the compression springs was reduced. It was necessary to periodically adjust the load on the cylinder to its original value as indicated by the strain in the tie-rods. A record was kept of the "SR-4" strain gage readings before and after load adjustment. These readings enabled the strain in the tie-rods to be determined and subsequently the load on the cylinder. As the testing program progressed it was noted that the strain gage readings were increasing. The increase in readings indicated an increase in the strain in the tie-rods and therefore an increasing load on the cylinder. This was improbable as the compressometer indicated that the sample was compressing and the load, therefore, was decreasing.

Readings of all the "SR-4" gages were observed and recorded at the end of the investigation, after all the specimens had been unloaded. These readings were compared with the initial readings that had been obtained prior to loading the cylinders. In nearly all cases a substantial difference in the two sets of readings was noted. This difference may be attributed to the instability of "SR-4" gages under sustained stress conditions. It was impossible to determine when the instability of the gages developed and therefore impossible to evaluate the magnitude of the loads sustained by the cylinders during the test program. Extreme care should be used in attempting to apply the test results obtained in this program to practical uses.

The compressometers appeared to function satisfactorily and results obtained, as discussed in the preceeding section, are in the proper order of magnitude. Some difficulty was encountered in the positioning and attachment of the compressometer to the cylinder with the cylinder in the loading frame. This difficulty was due to inexperience in the handling of the equipment and was overcome as the program progressed. The strain results obtained with the compressometer check reasonably well with the results obtained using the "Demec" gauge. There are some variations, however, and in some cases the variations are large. These variations may be due

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to difficulty in seating the "Demec" gauge properly in the gauge bars. The holes that were drilled in the gauge bars cast in the test cylinders were not round. As a result the "Demec" gauge could not be properly seated and any variation in the pressure of the operators hands on the gauge as it was being placed between the gauge bars resulted in different readings being observed. The variation in readings was not as noticeable with readings taken on the shrinkage beams because the stainless steel gauge points used in the shrinkage beams were drilled in the machine shop before they were cast in the beams. The gauge point holes obtained were almost perfectly round. All gauge bars should therefore be drilled in the machine shop to ensure uniform round holes as gauge seats.

The gauge bars that were cast in the shrinkage beams showed a tendency to become loose as the program progressed. This was due to the repeated stress placed on the bars each time the "Demec" gauge was placed in position. The size of gauge bars used in the shrinkage beams should therefore be increased to provide more bonding area with the concrete.

Certain modifications are advisable if the apparatus used in this investigation is to be used in subsequent investigations. A method, other than "SR-4" strain gages, should be developed for determining

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Certain modifications are advisable if the apparatus used in this investigation is to be used in subsequent investigations. A method, other than "SR-4" strain gages, should be developed for determining

the load on the specimen. Other investigators (3),(7),(55) have used a calibrated hydraulic ram to determine and adjust the load carried by the specimen. An attempt was made in this investigation to correlate the load indicated on a pressure gauge attached to the hydraulic ram with the load determined from the strain in the tie rods as measured with the "SR-4" gages. No consistent relationship was found as the load indicated on the pressure gauge was from 4000 to 6000 pounds higher than the load determined using the strain gage readings. A precise pressure gauge might allow more accurate load determinations.

Monfore(26) has developed a standardizing strain gauge for measurements requiring long-time stability. This gauge or one similar to it might be used to replace the "SR-4" strain gages on the tie rods. A gauge of this type might also be placed in the center of the concrete specimen to measure flow.

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Monfore(24) has developed a standardizing strain gauge for measurements requiring long-time stability. This gauge or one similar to it might be used to replace the "SR-4" strain gages on the tie rods. A gauge of this type might also be placed in the center of the concrete specimen to measure flow.

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

The loading frames and compressometers provided a suitable means of determining the flow of concrete under a sustained load. The "SR-4" wire resistant strain gages that were attached to the tie rods of the loading frames proved to be unstable under a sustained load. Another method should be developed for determining the load sustained by the test cylinder. All gauge bars should be drilled in the machine shop to provide uniform round holes as gauge seats. The gauge bars and "Demec" gauge should be used in conjunction with the compressometer until results obtained from both methods of strain measurement are almost identical. The gauge points used in the shrinkage beams should be of a larger size than used in this program.

The results obtained from the experimental program generally agree with current opinion. Jones and Hirsch(16) report that the range of shrinkage values to be expected from expanded shale and natural aggregate concretes stored at a relative humidity of 60% at an age of 160 days is between 300 and 750 microinches per inch. The range of creep to be expected in similar specimens stored under identical conditions and subjected to stresses not exceeding 0.6 f'_c is

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

The loading frames and compressometers provided a suitable means of determining the flow of concrete under a sustained load. The "SR-4" wire resistant strain gages that were attached to the tie rods of the loading frames proved to be unstable under a sustained load. Another method should be developed for determining the load sustained by the test cylinder. All gauge bars should be drilled in the machine shop to provide uniform round holes as gauge seats. The gauge bars and "Whittemore" gauge should be used in conjunction with the compressometer until results obtained from both methods of strain measurement are almost identical. The gauge points used in the shrinkage beams should be of a larger size than used in this program.

The results obtained from the experimental program generally agree with current opinion. Jones and Hirsch(13) report that the range of shrinkage values to be expected from expanded shale and natural aggregate concretes stored at a relative humidity of 50% at an age of 180 days is between 300 and 700 microinches per inch. The range of creep to be expected in similar specimens stored under identical conditions and subjected to stresses not exceeding $0.4\ f'_c$ is

between 400 and 850 microinches per inch for specimens loaded at ages exceeding 14 days. The magnitude of flow measured in this program was between 960 and 1949 microinches per inch and the magnitude of shrinkage was between 335 and 480 microinches per inch. The shrinkage values agree quite well and the discrepancy between the measured flow and the sum of the creep and shrinkage values obtained by Jones and Hirsch may be explained by the difference in ages when the sustained loads were applied.

Best and Polivka(3) state that lightweight concrete made with expanded-shale aggregates may be expected to creep no more than concrete of comparable strength made with sand and gravel, other things being equal. They also state that drying shrinkage is considerably less for lightweight concrete than for regular concrete. The test results show a good correlation between magnitudes of flow that occurred in samples of comparable strength for the two types of concrete. Test results also show that the magnitude of shrinkage that occurred in the lightweight specimens was lower than the magnitude of shrinkage that occurred in the regular concrete specimens.

The effect of the variables studied, on the flow of concrete, may be better defined by further experimental work. It is recommended that the investigation be continued with particular emphasis placed on

determining the magnitude of flow resulting in lightweight and natural aggregate concretes, of comparable strengths, under similar conditions. If a definite relationship can be established between the flows that occur in the two types of concrete, future investigators will only have to study one type of concrete to obtain results applicable to both types. It is also recommended that a program be instigated to develop a more reliable load measuring device and that in subsequent investigations the shrinkage specimens be of the same size and shape as their companion loaded specimens. This would enable the investigator to determine the magnitude of creep that occurred and would permit a better correlation with published data.

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CORRESPONDENCE

57. Mr. Truman R. Jones, Jr.,
Associate Research Engineer
Texas Transportation Institute
Texas A & M College System
College Station
Texas, U.S.A.

58. Mr. J. R. Keeton,
U. S. Naval Civil Engineering Laboratory
Port Hueneme, California.

59. Professor Inge Lyse,
Director of the Concrete Laboratory,
Norway's Institute of Technology,
Frondheim, Norway.

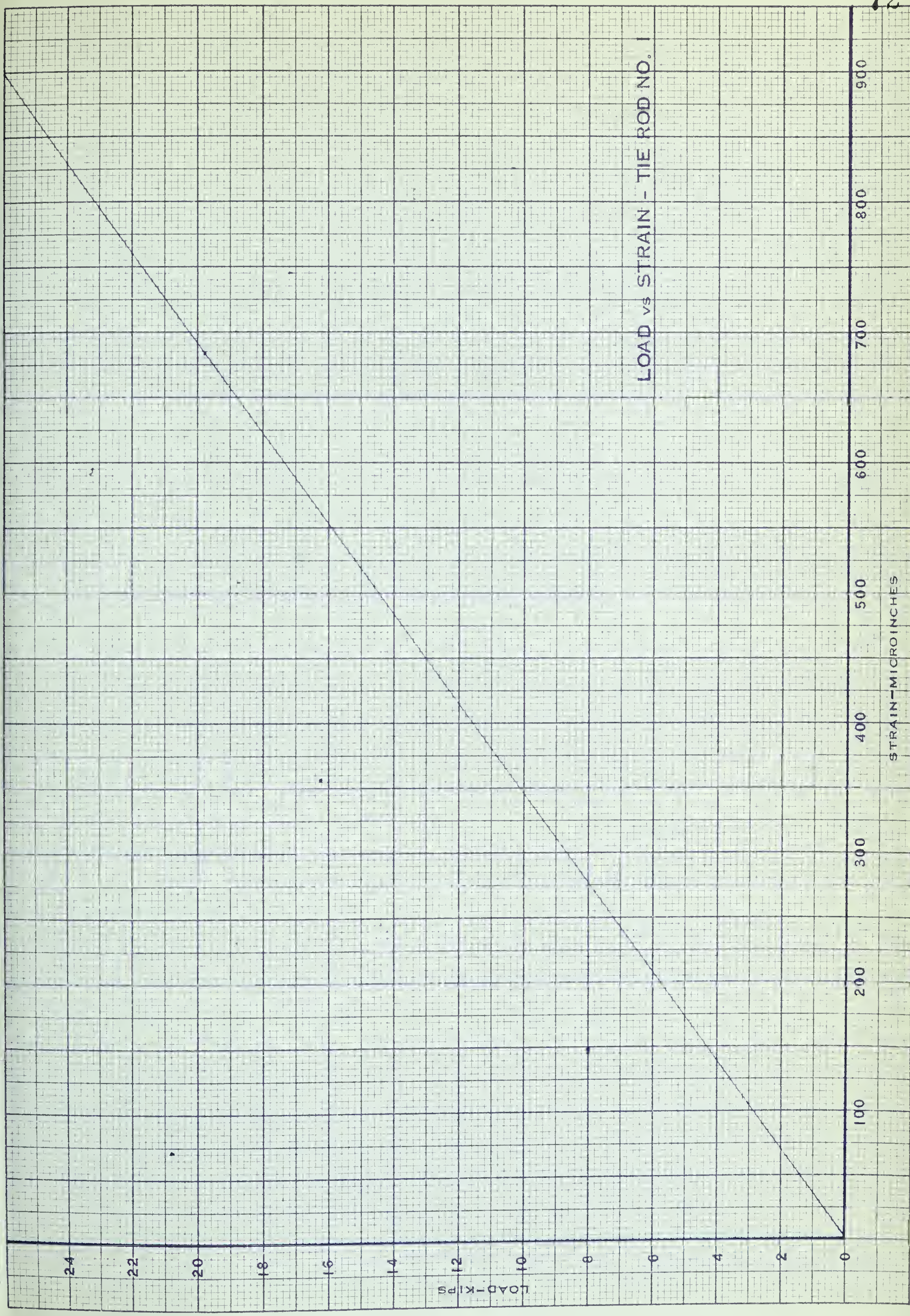
60. Mr. G. E. Monfore,
Research Engineer,
Research and Development Division
Portland Cement Association
Chicago, Illinois, U.S.A.

61. Mr. Gordon Plewes
Division of Building Research
National Research Council
Ottawa 2, Ontario.

62. Mr. Grover L. Rogers
Professor of Civil Engineering
Virginia Polytechnic Institute
Blacksburg, Virginia, U.S.A.

APPENDIX I

TIE ROD CALIBRATION CURVES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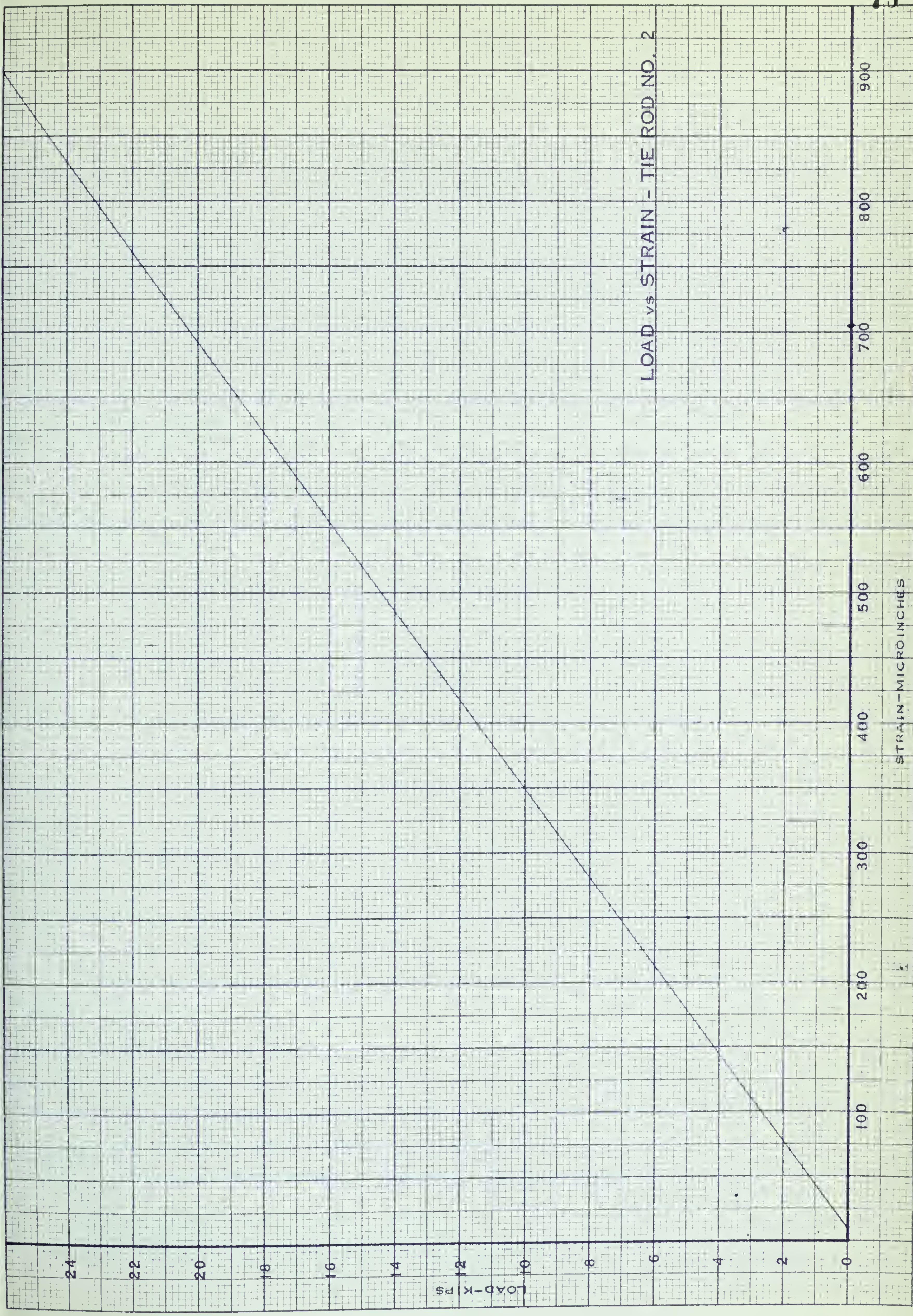

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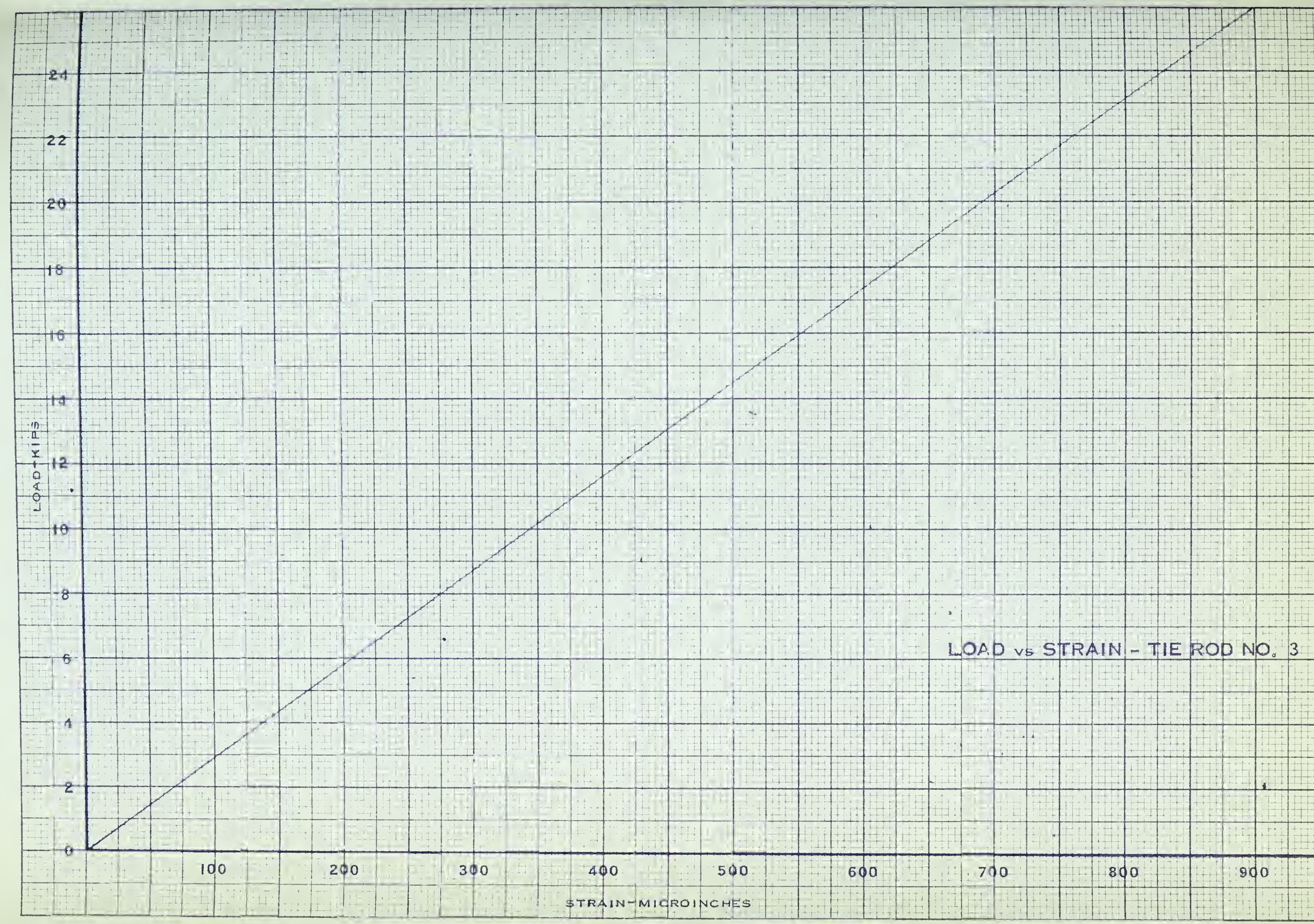
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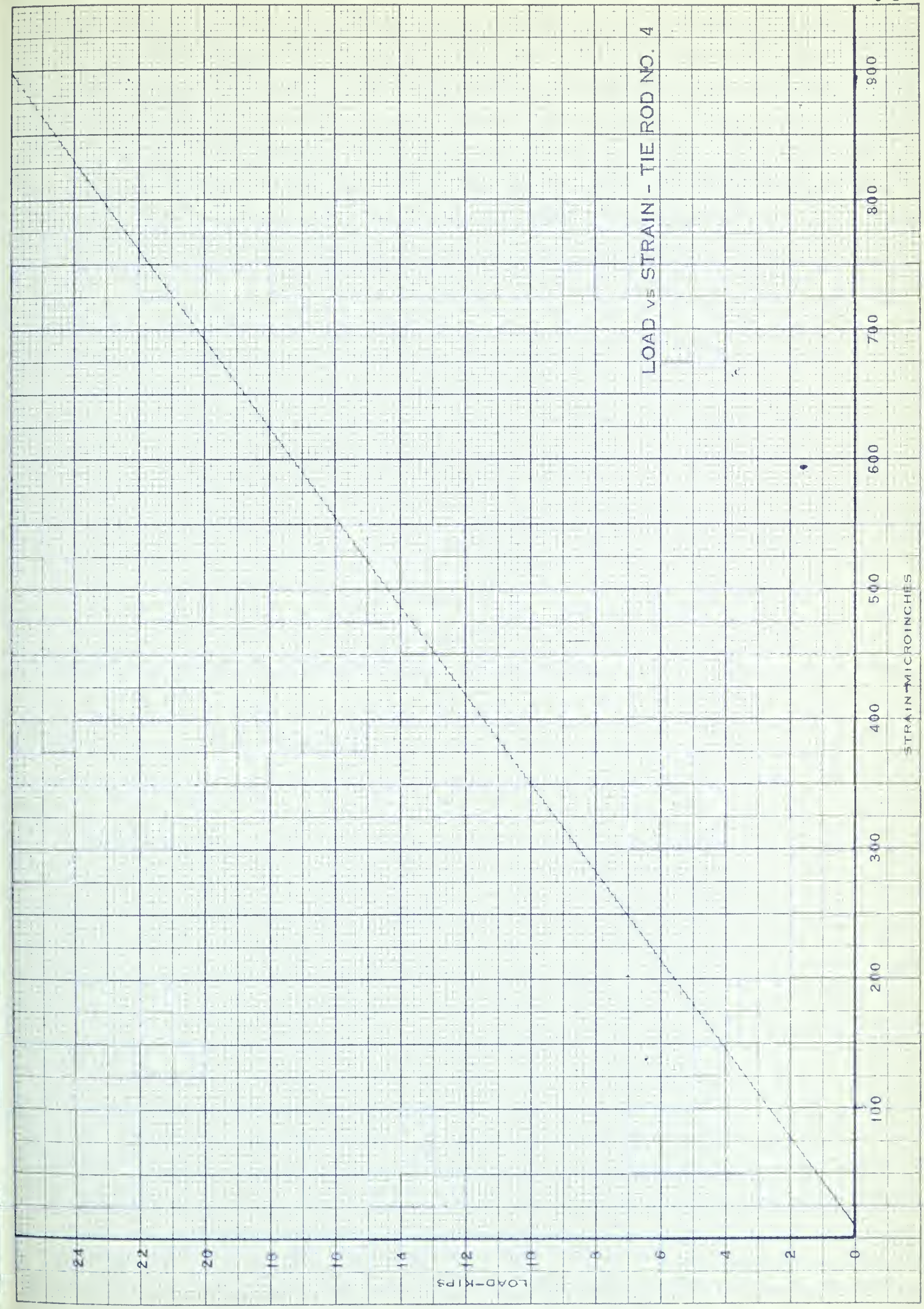
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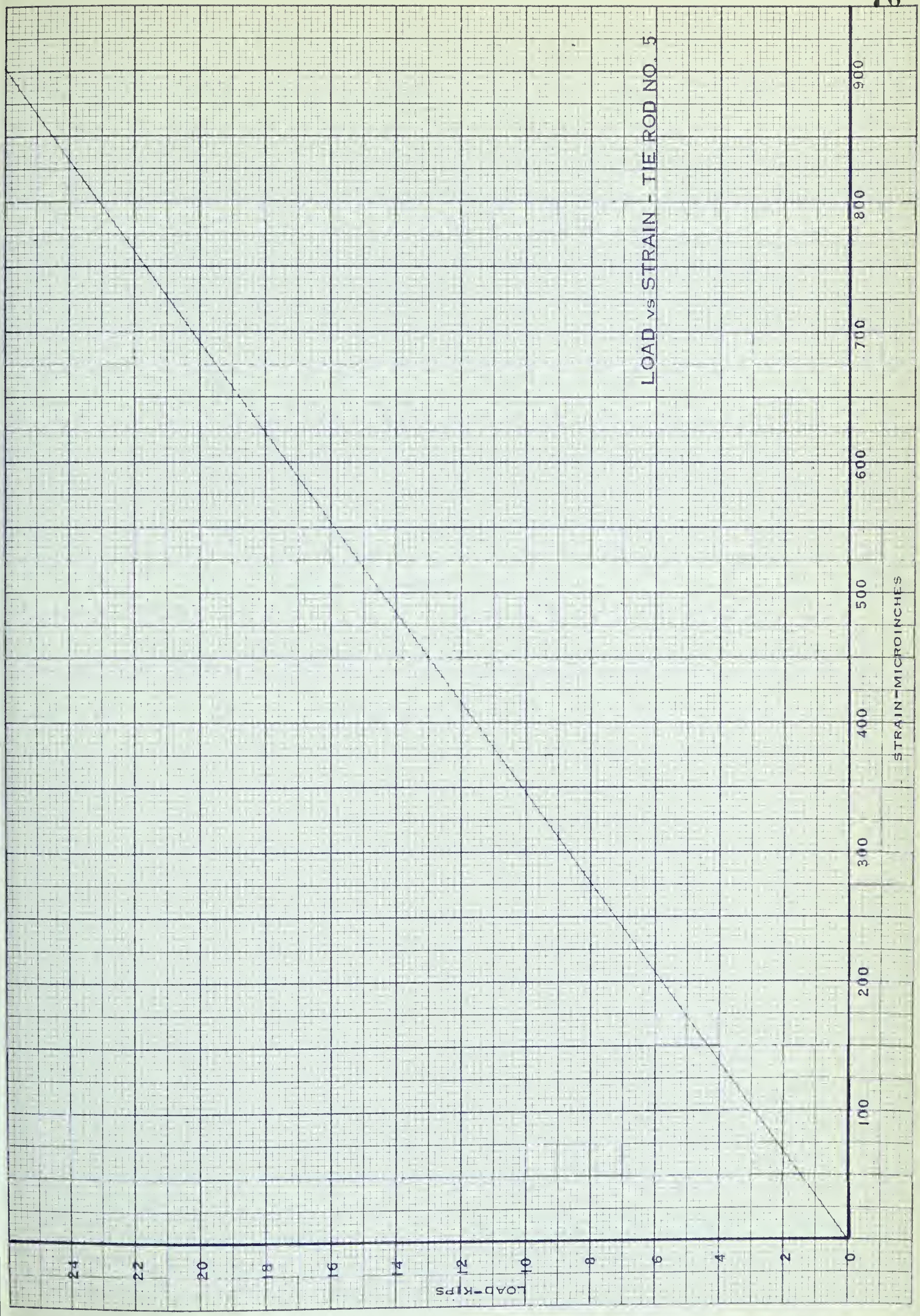

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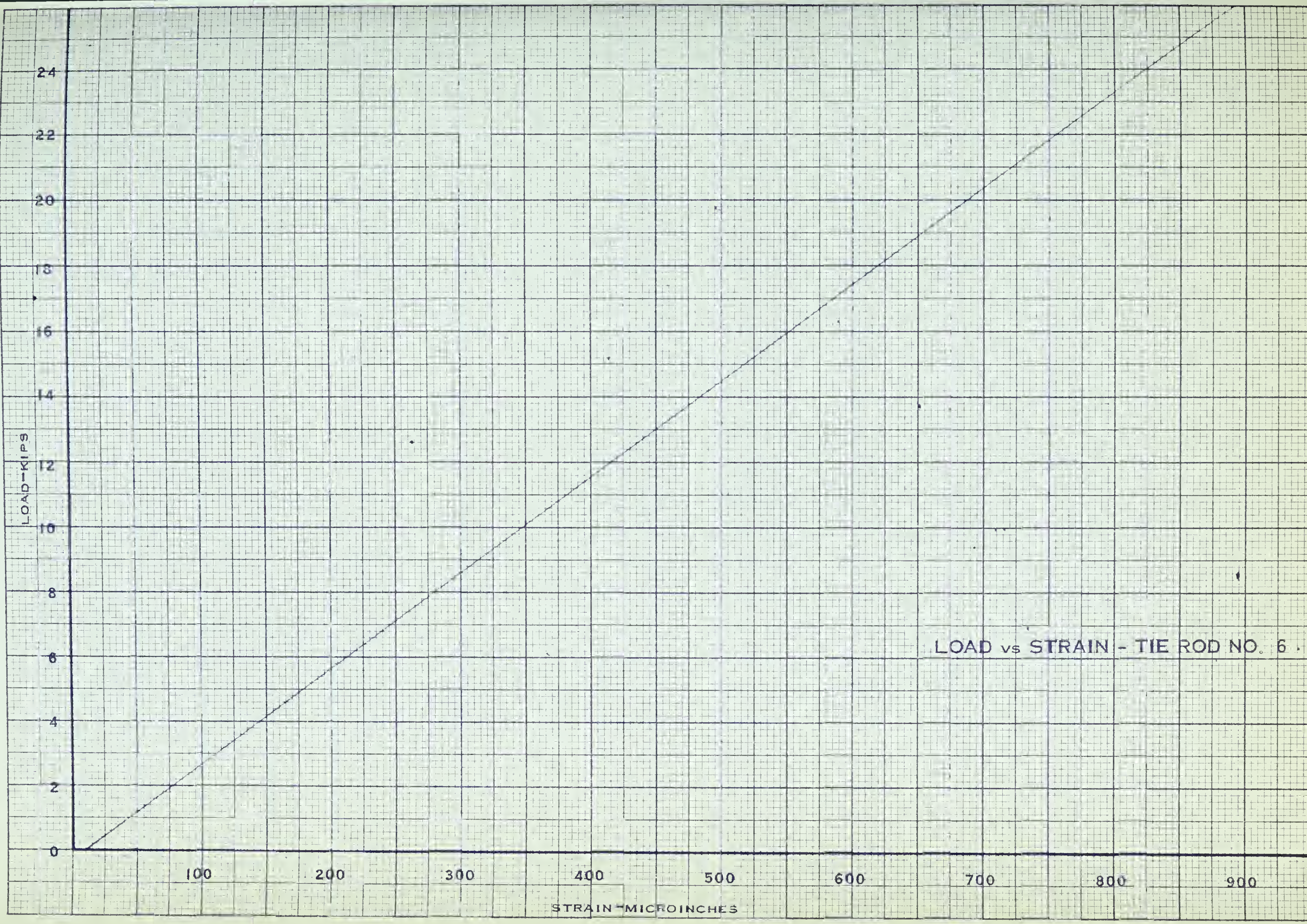

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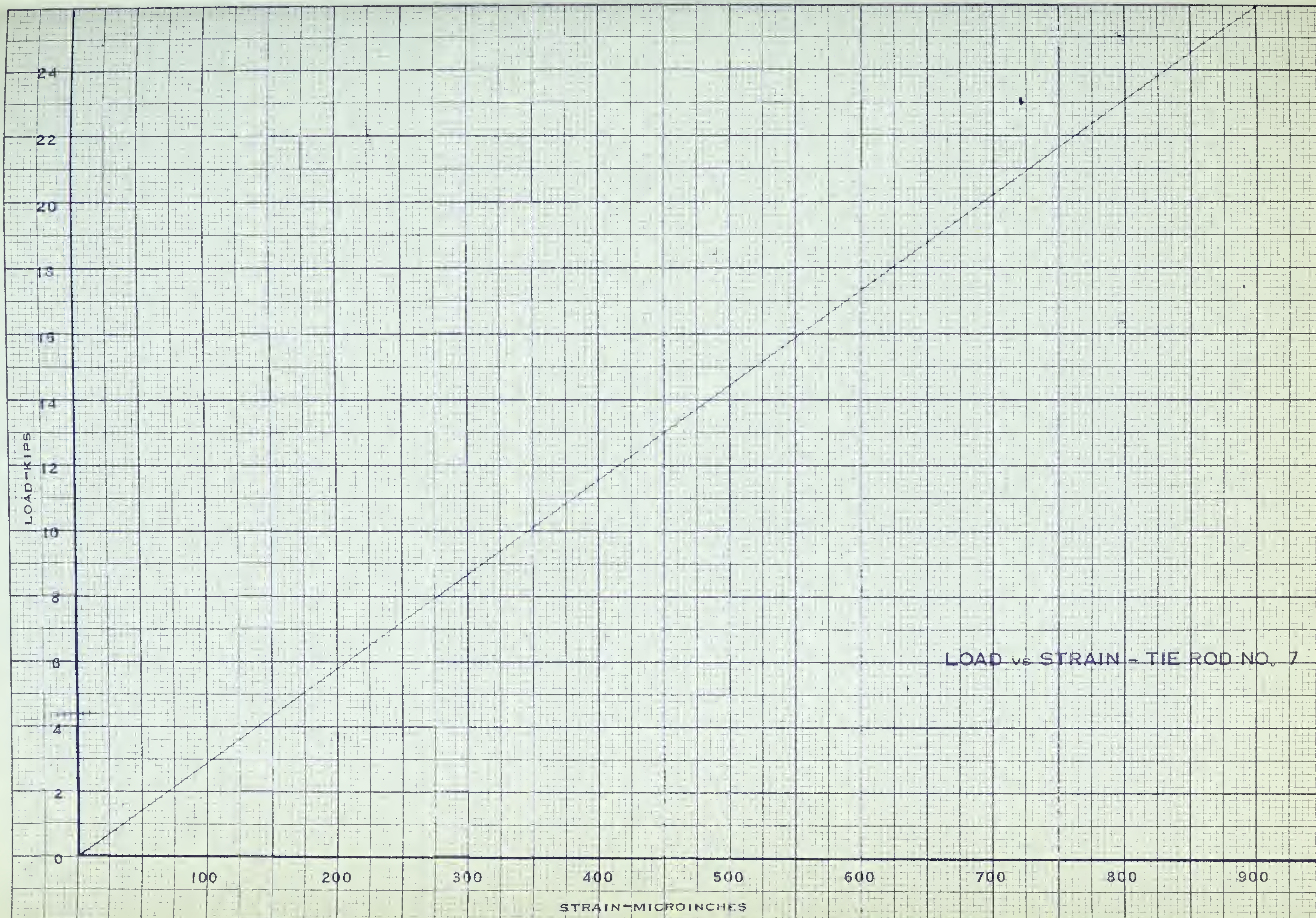
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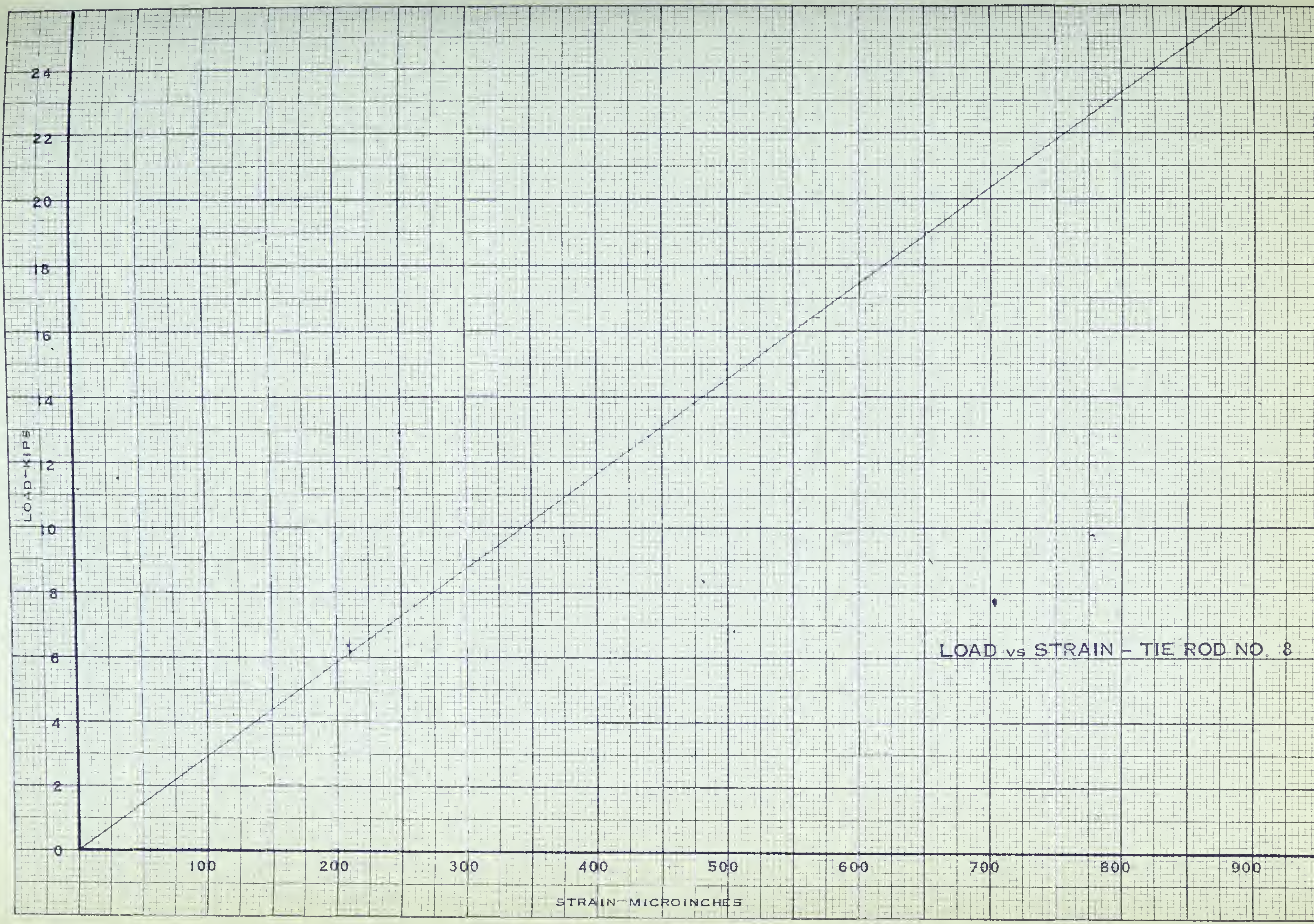
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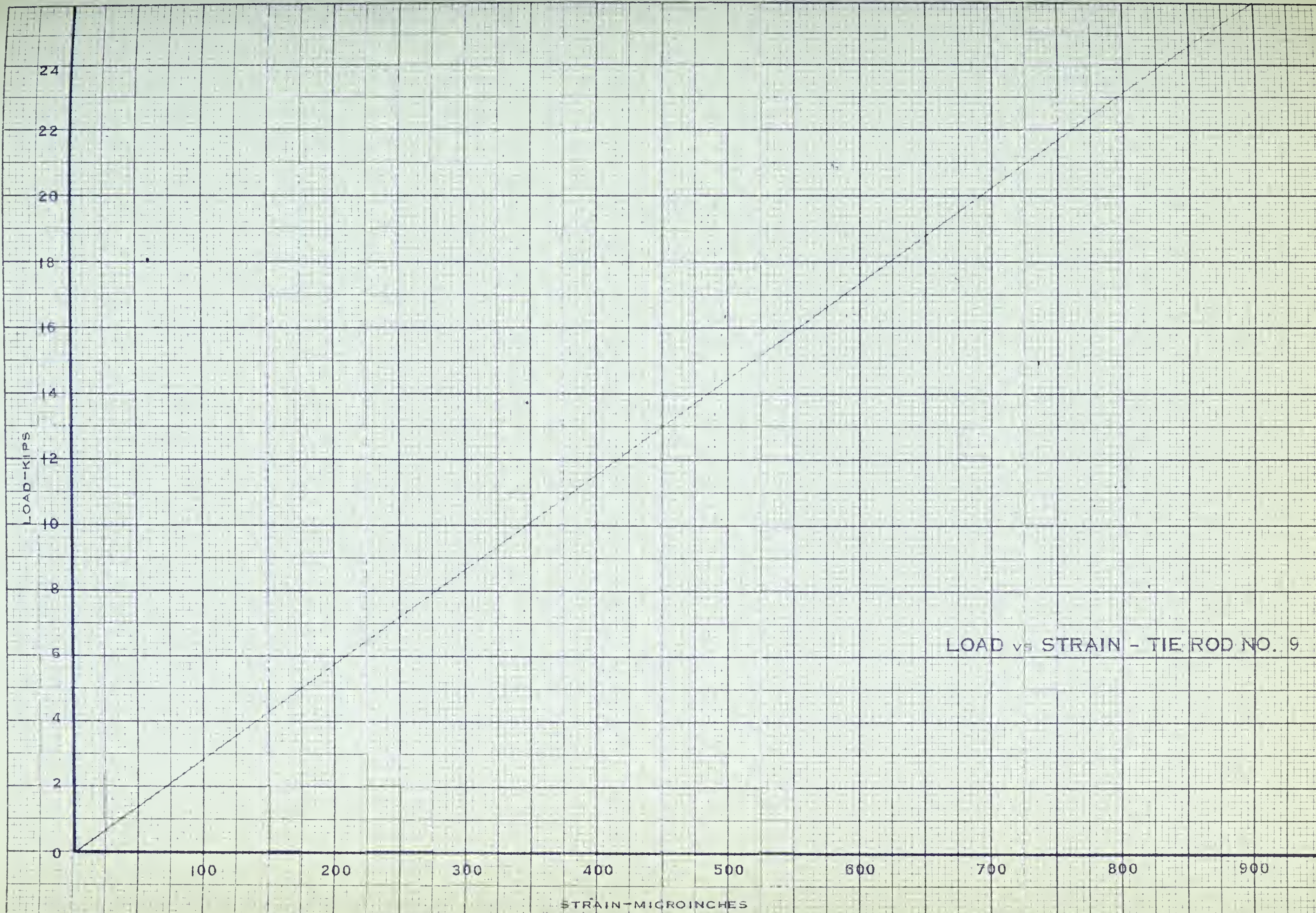

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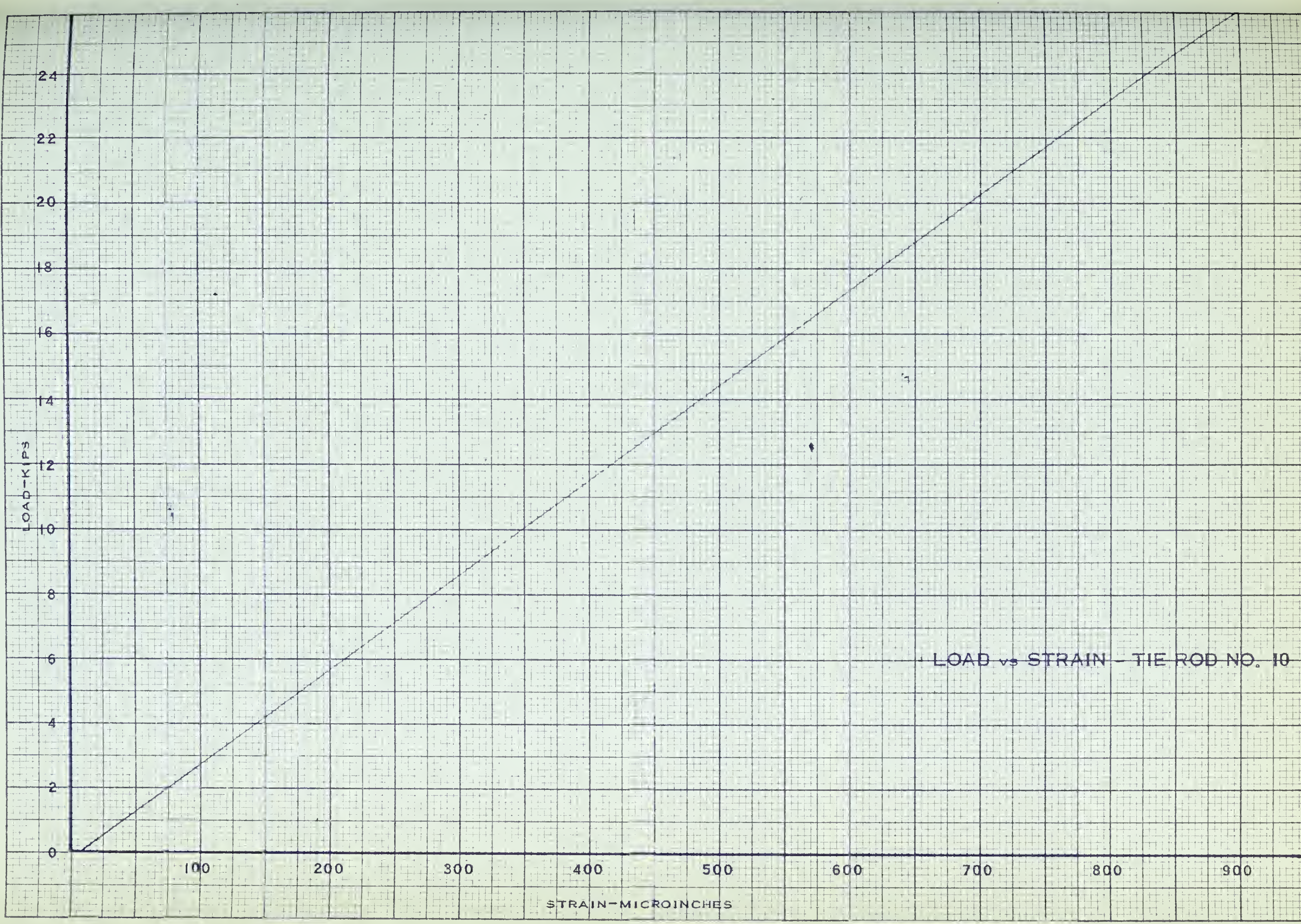
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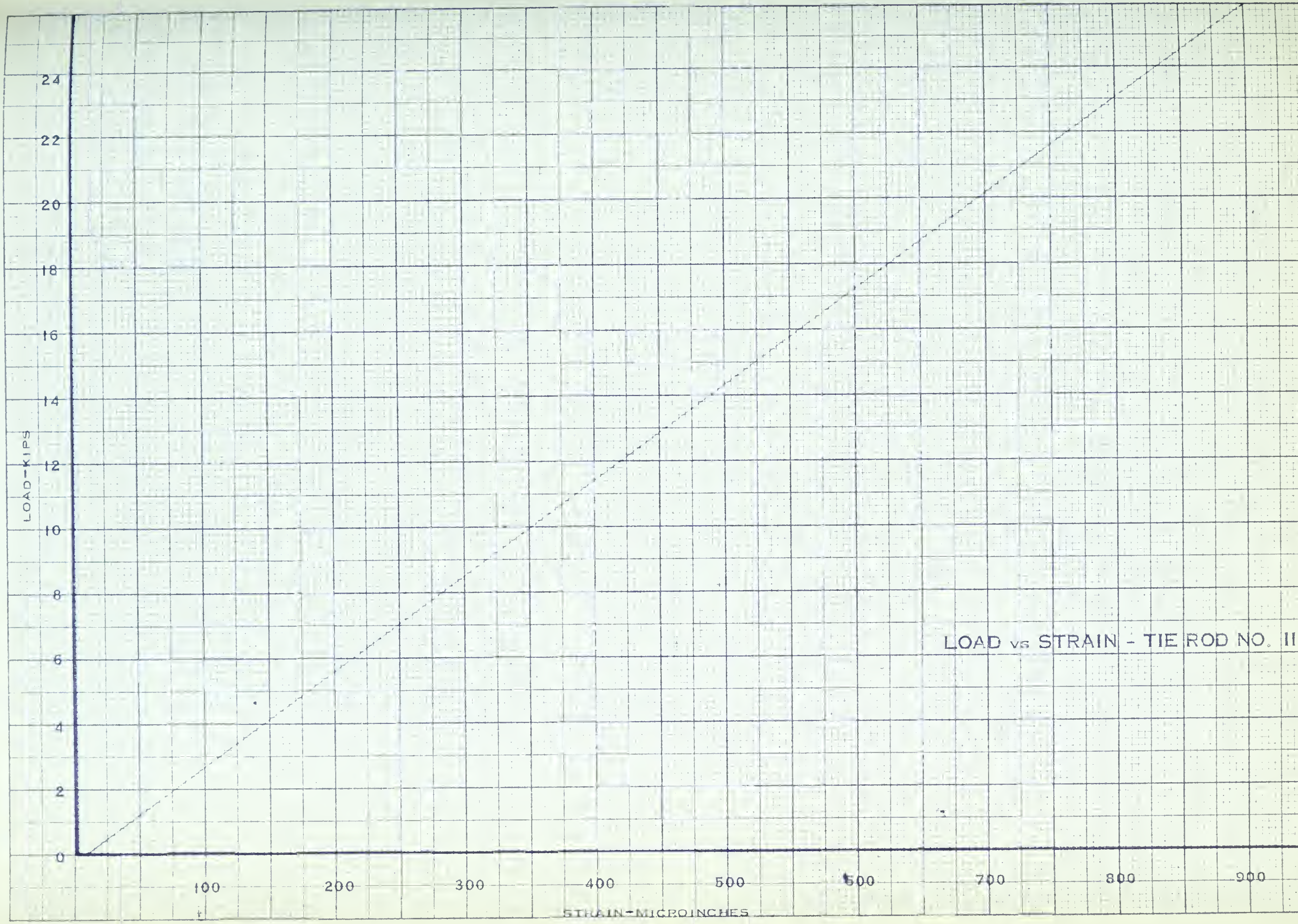
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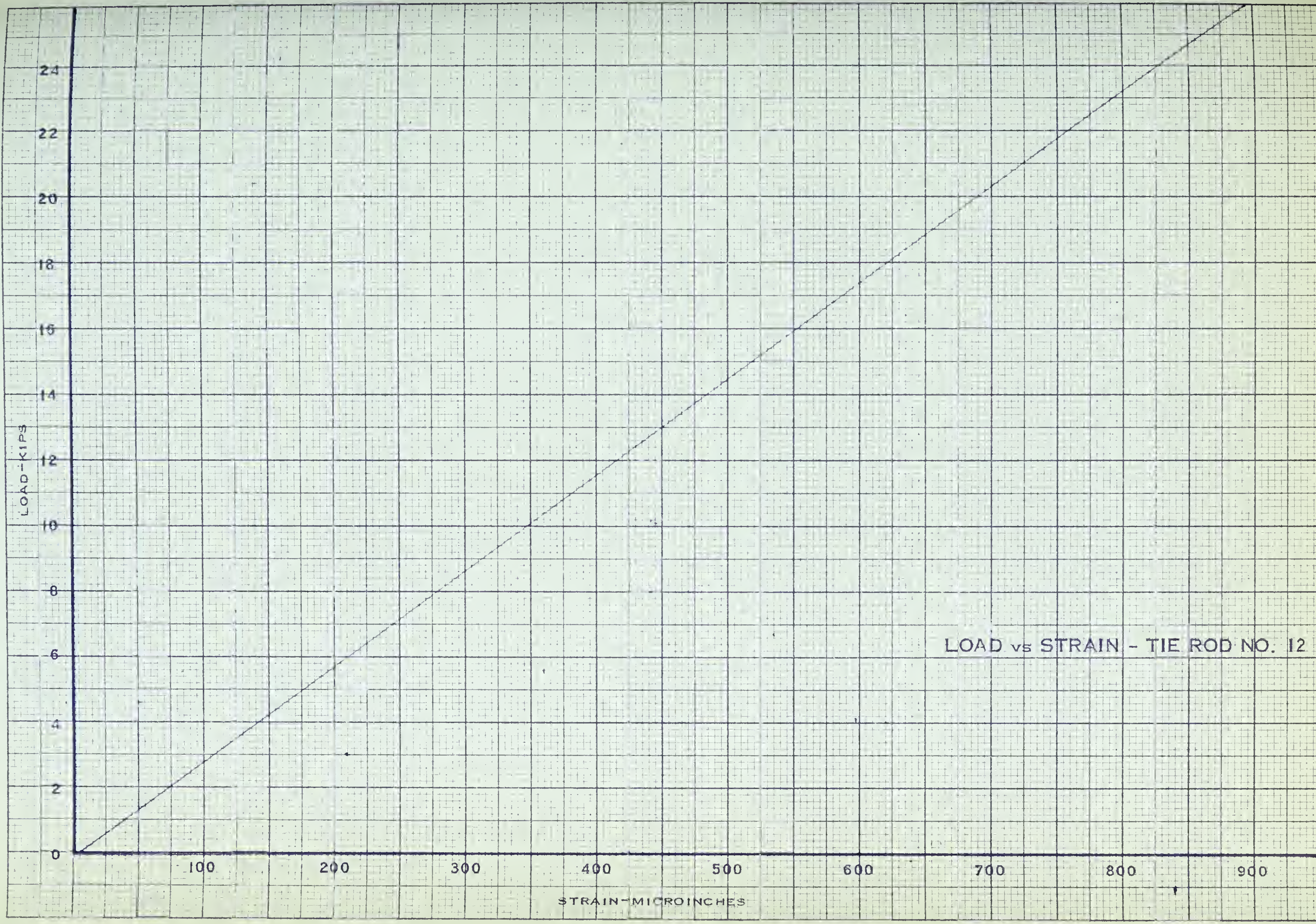
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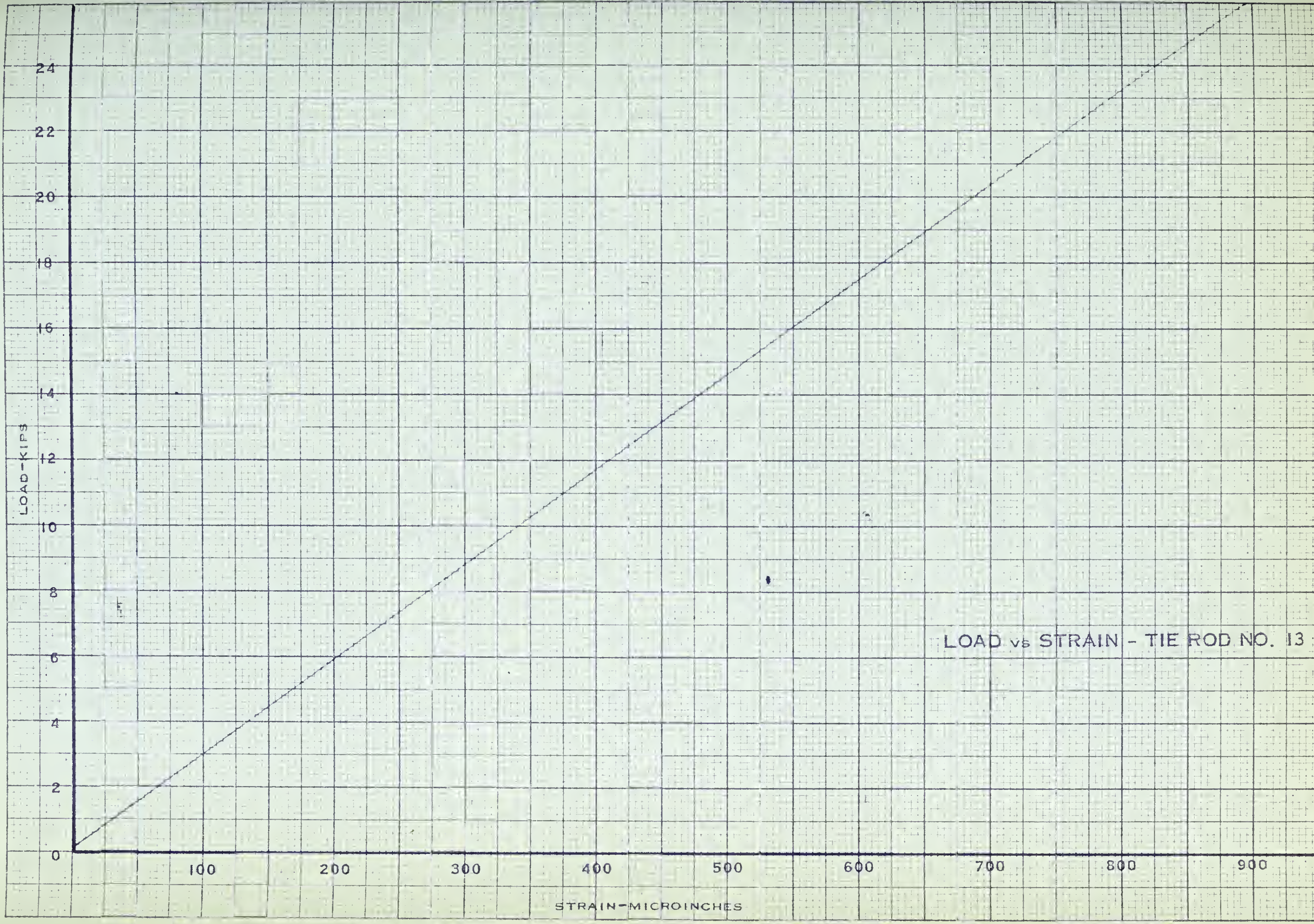
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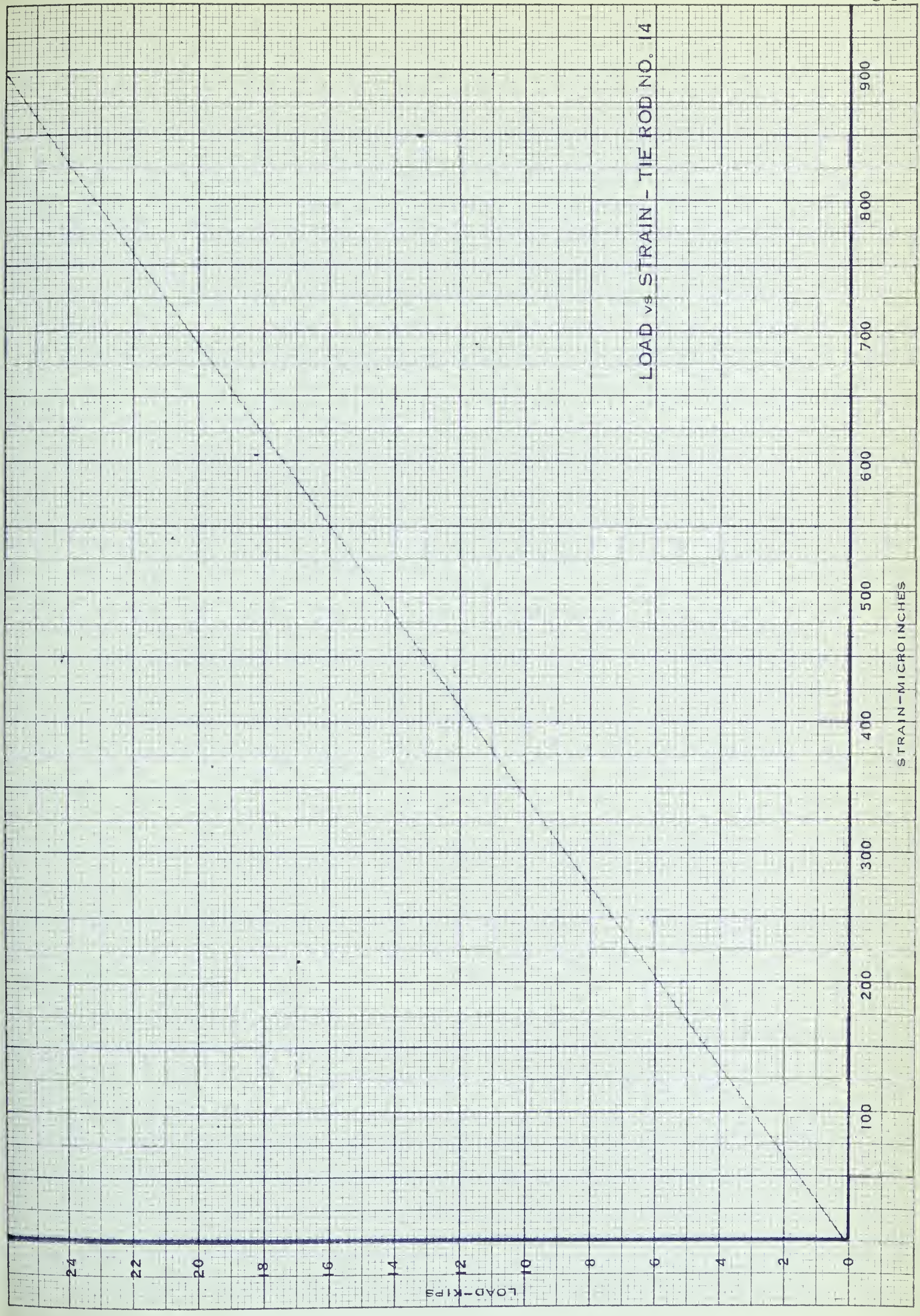
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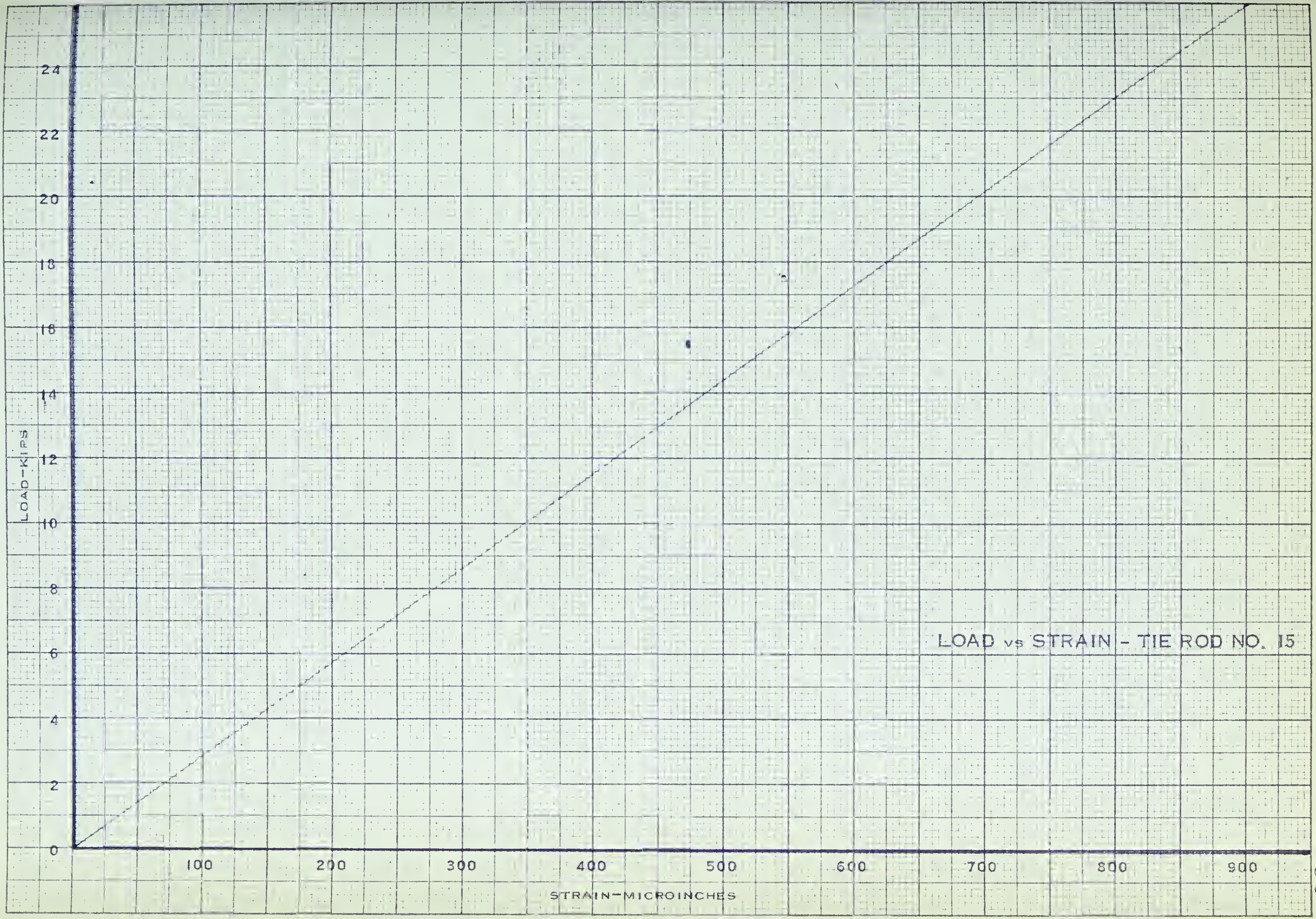

LOAD vs STRAIN - TIE ROD NO. 15
LOAD-KIPS
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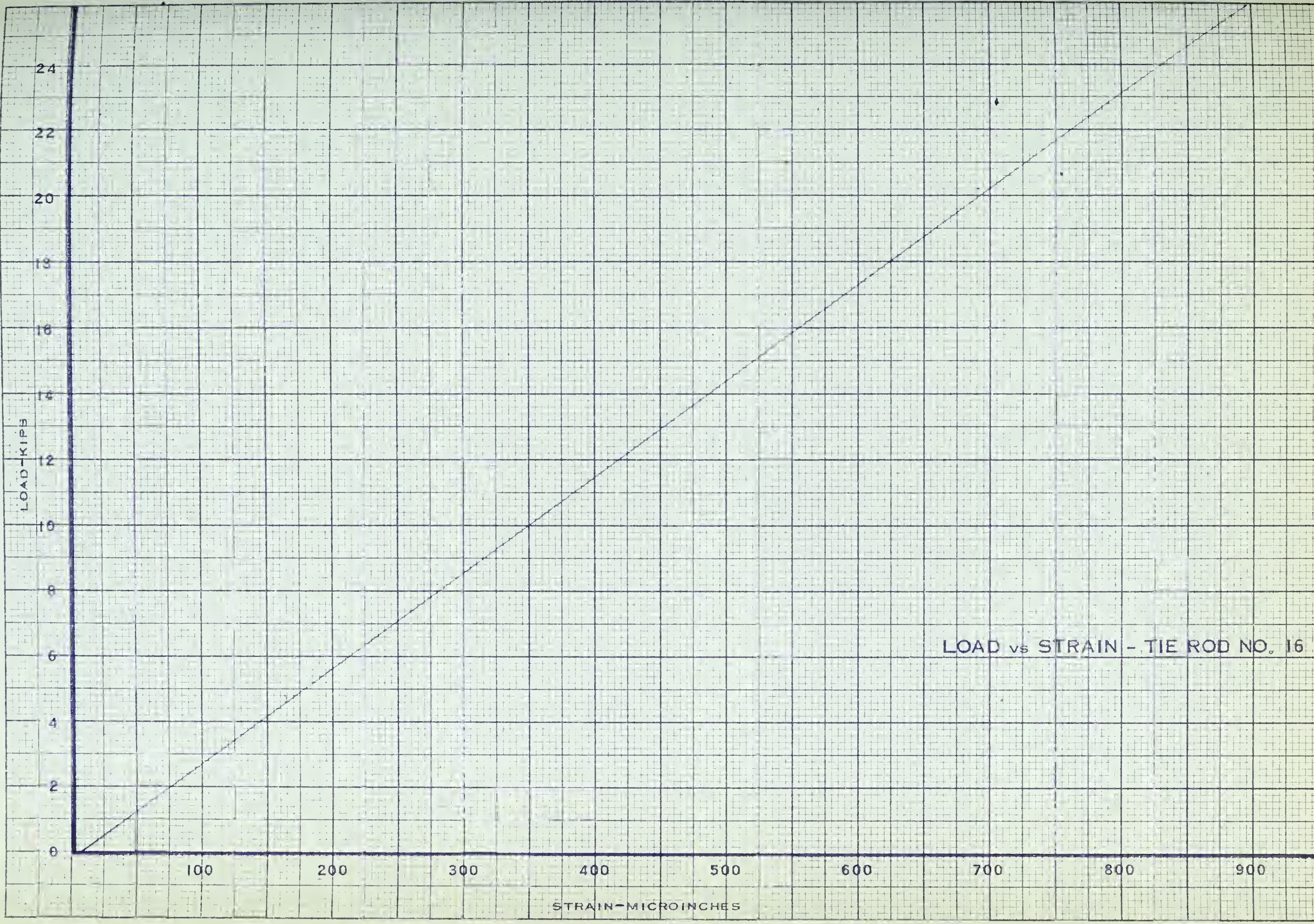
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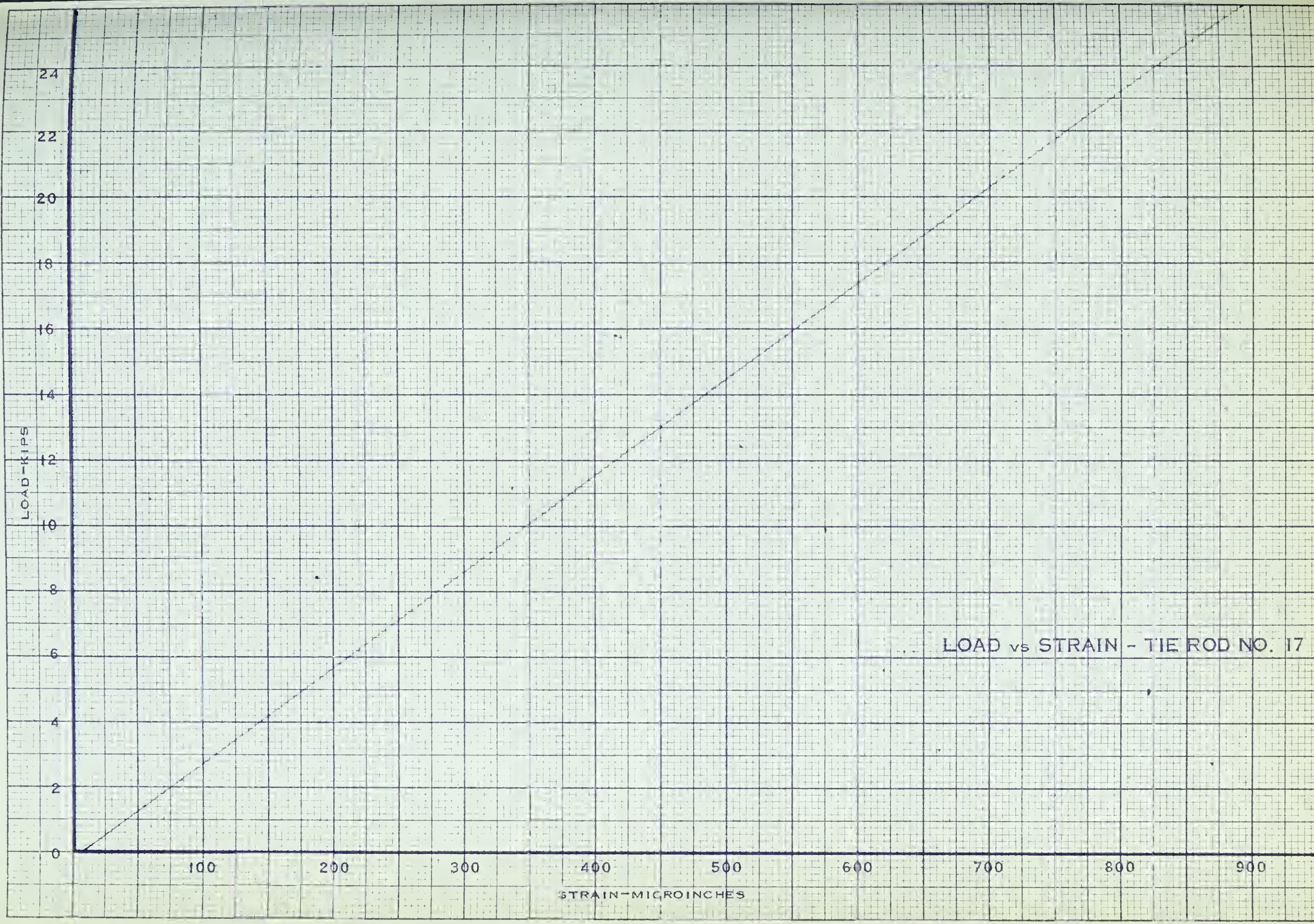
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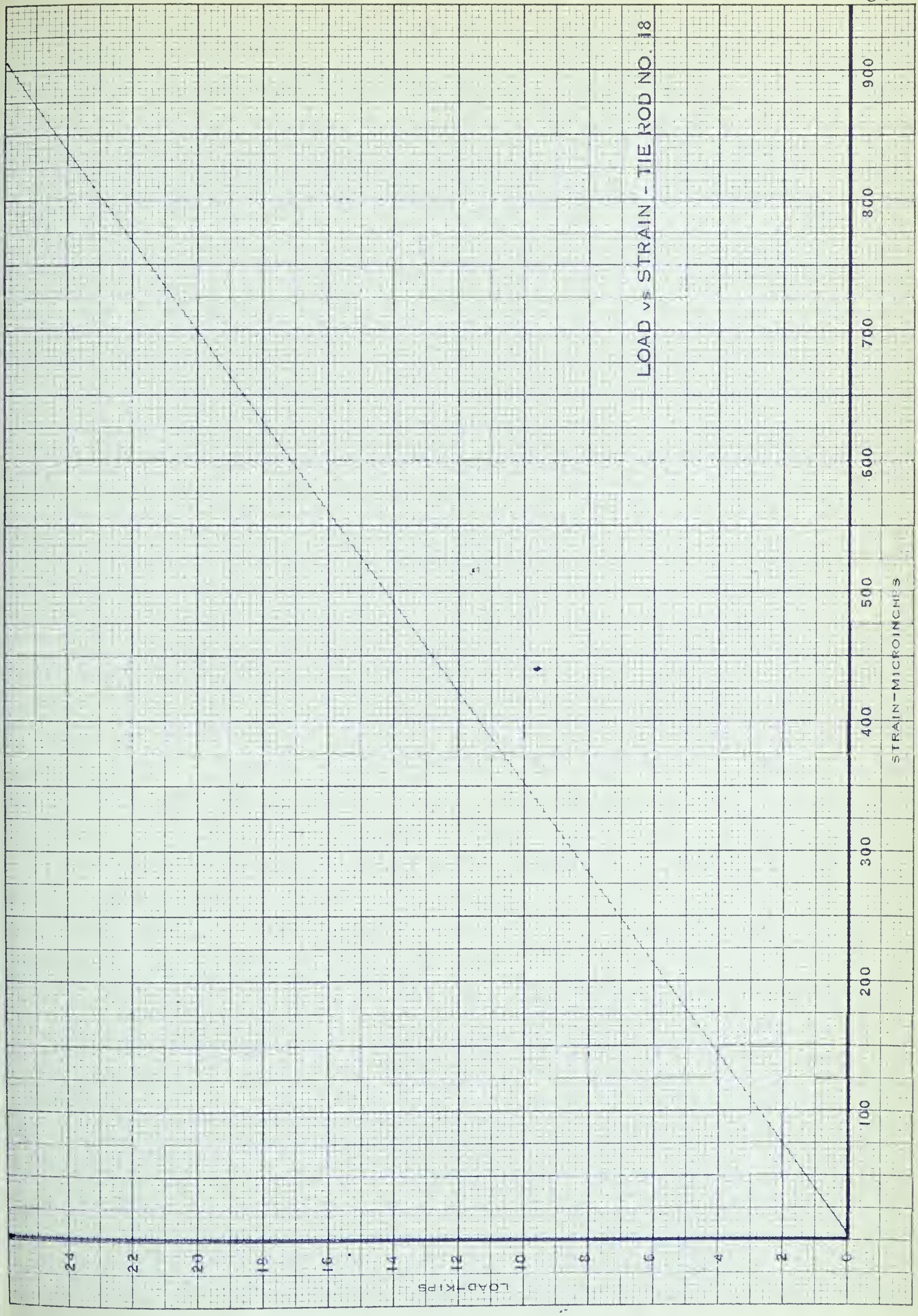
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LOAD-KIPS
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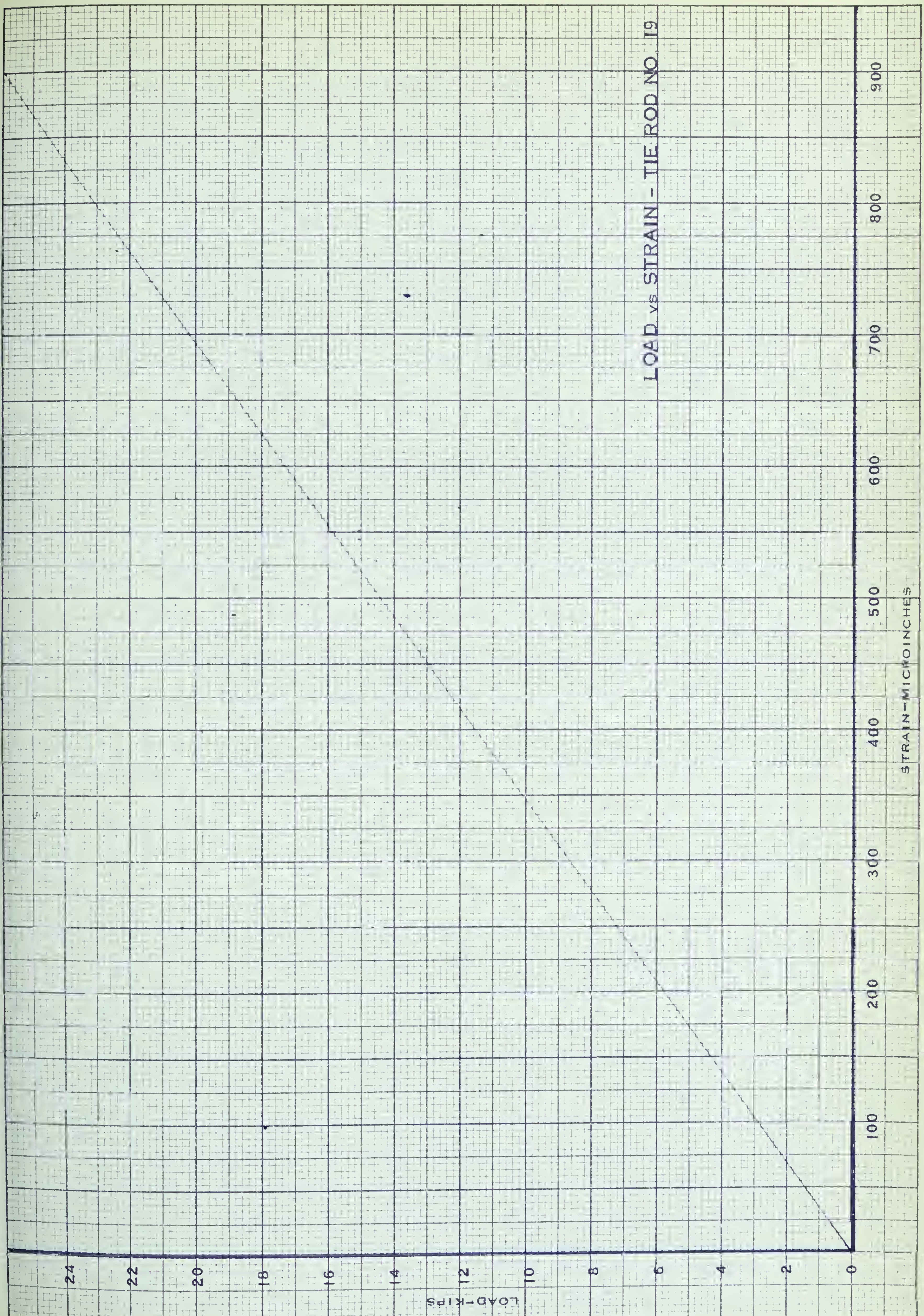
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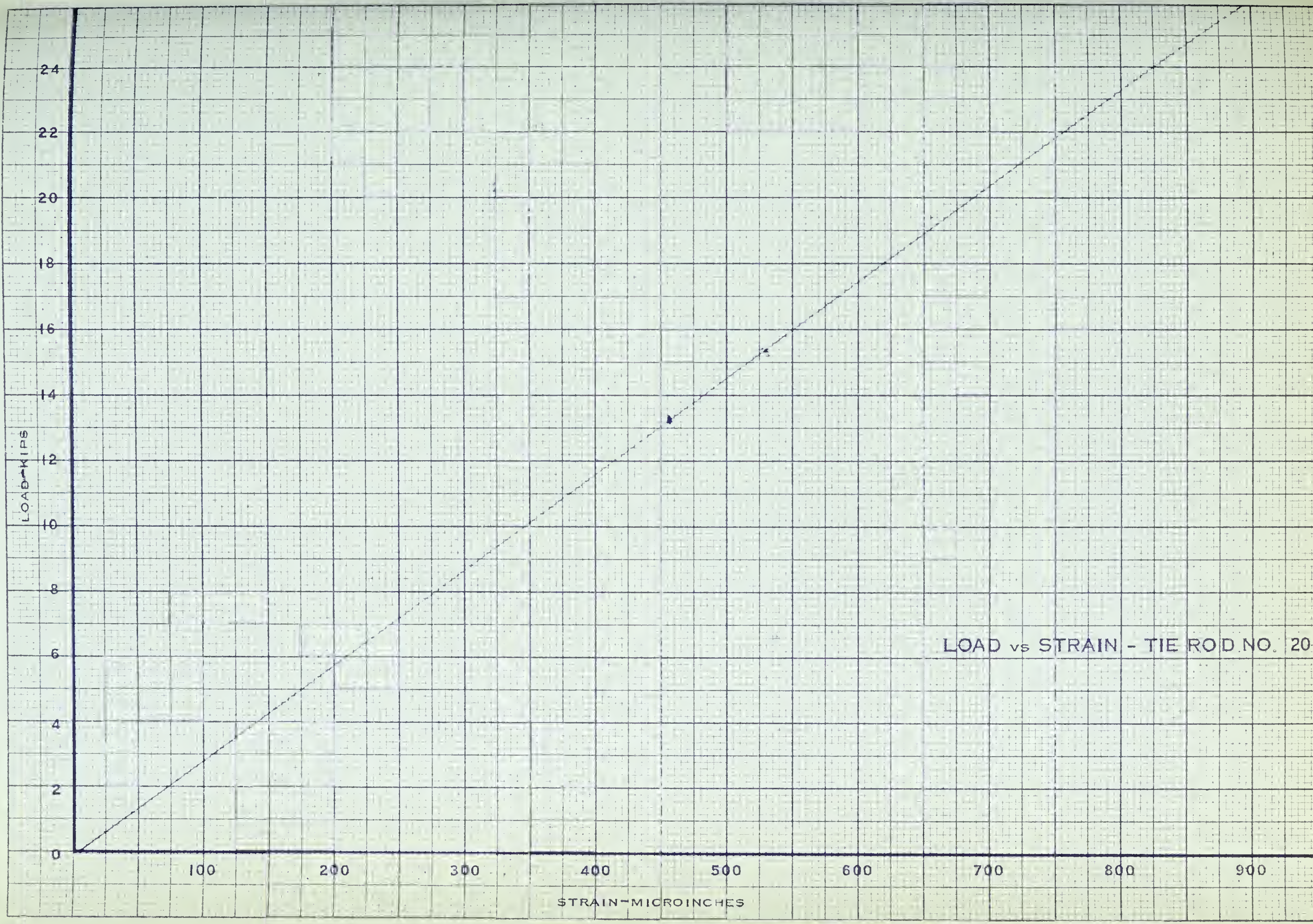
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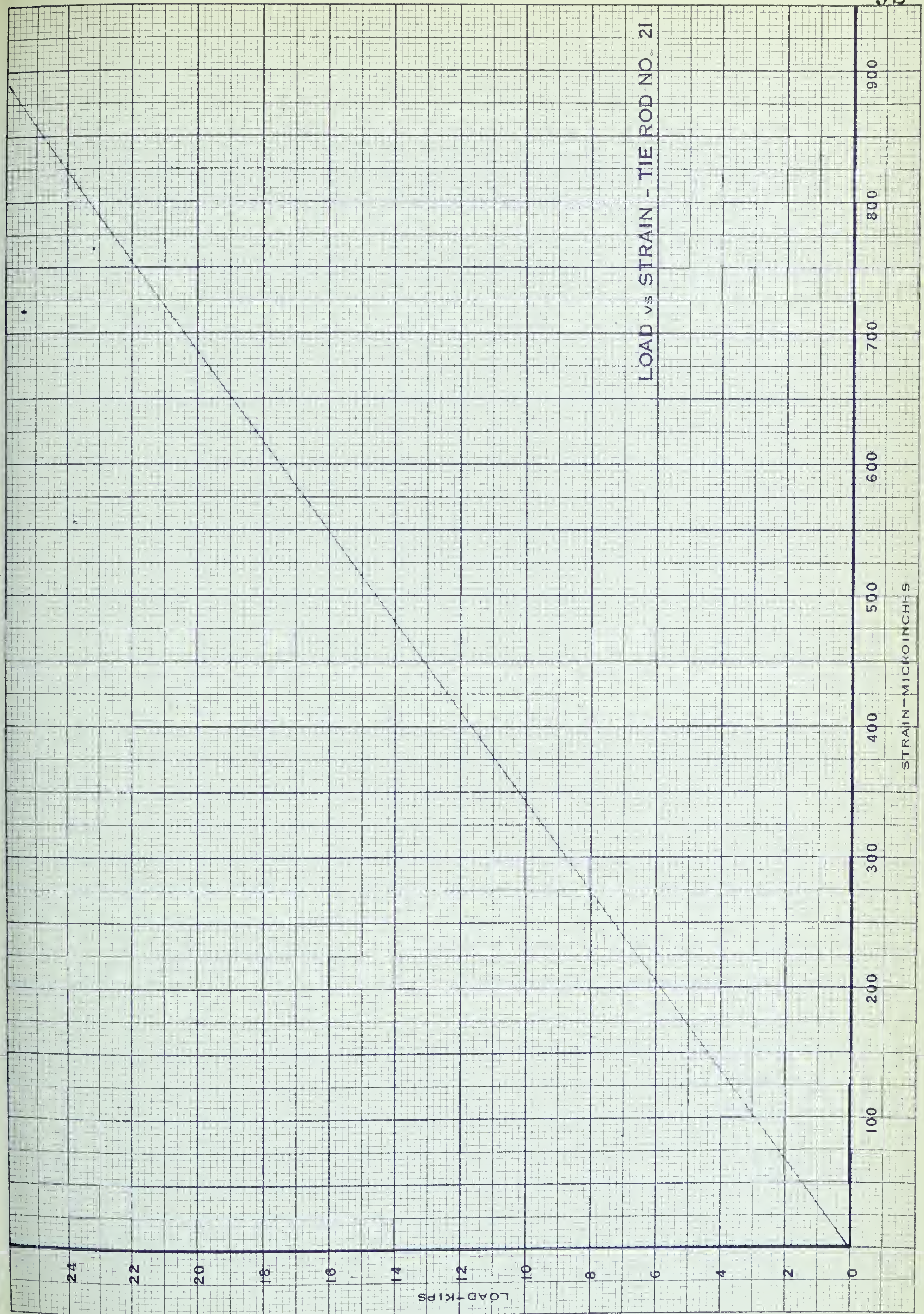
STRAIN-MICROINCHES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STRAIN-MICROINCHES
LOAD-KIPS
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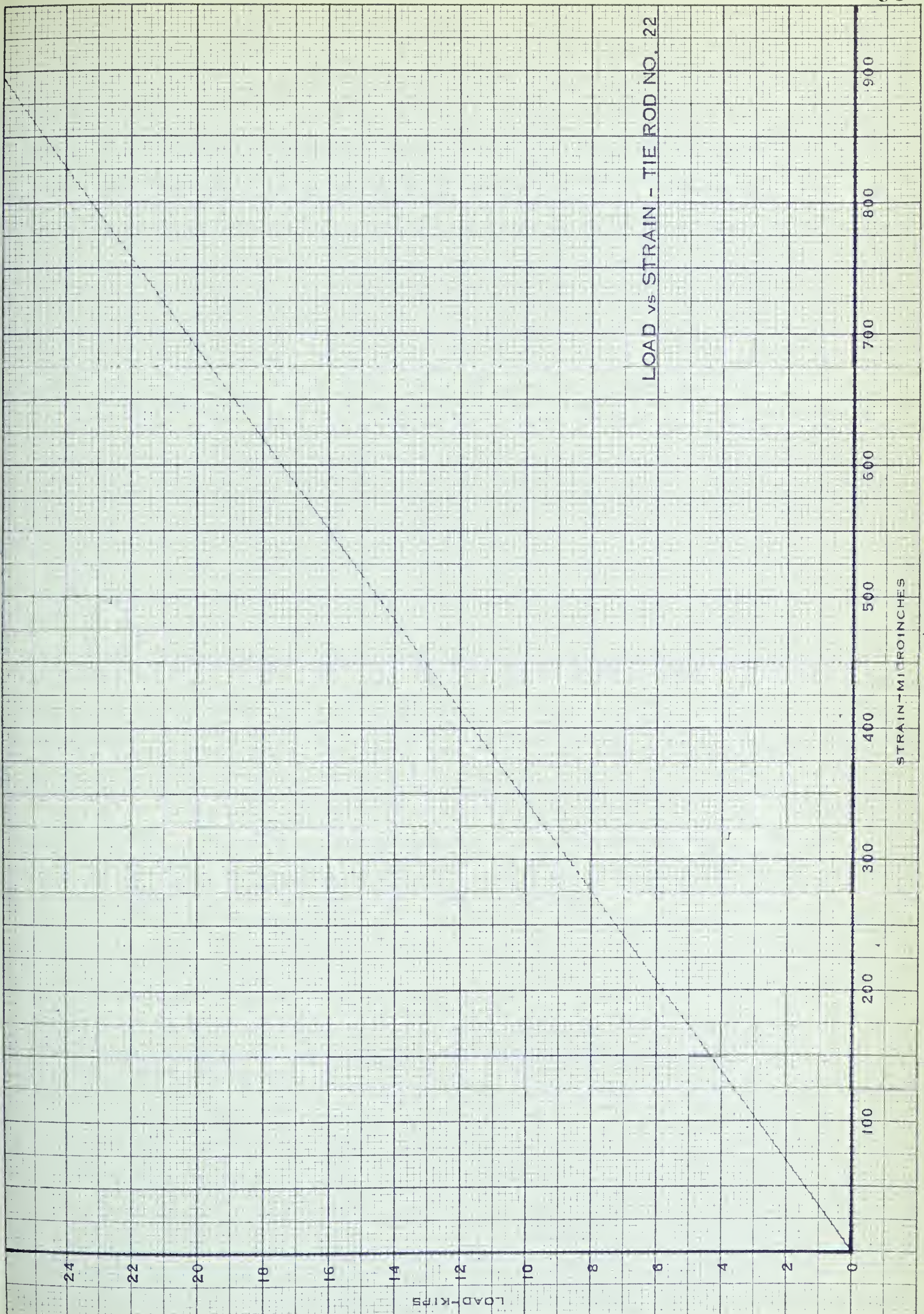
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STRAIN-MICROINCHES
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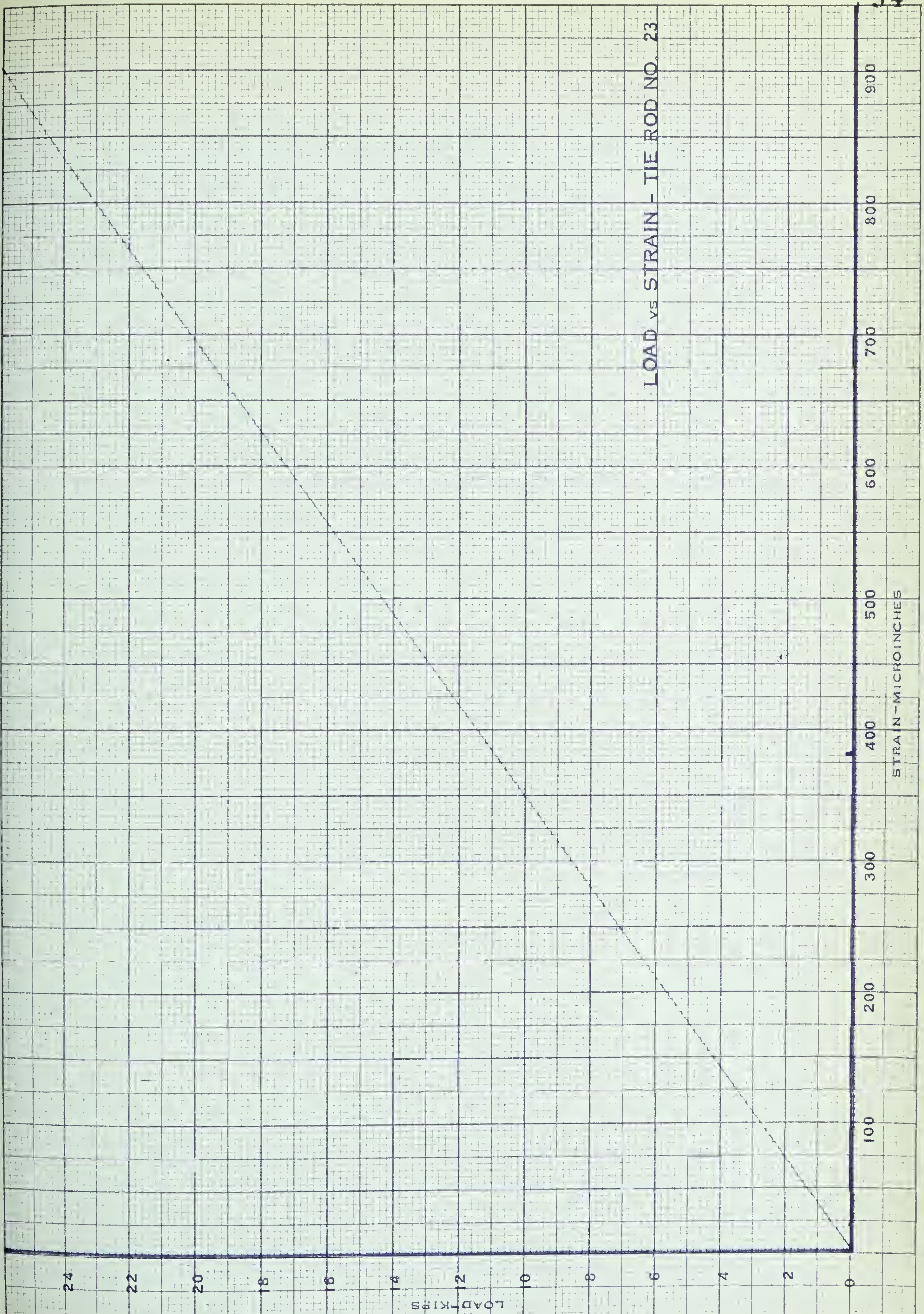
LOAD vs STRAIN - TIE ROD NO. 23
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STRAIN-MICROINCHES
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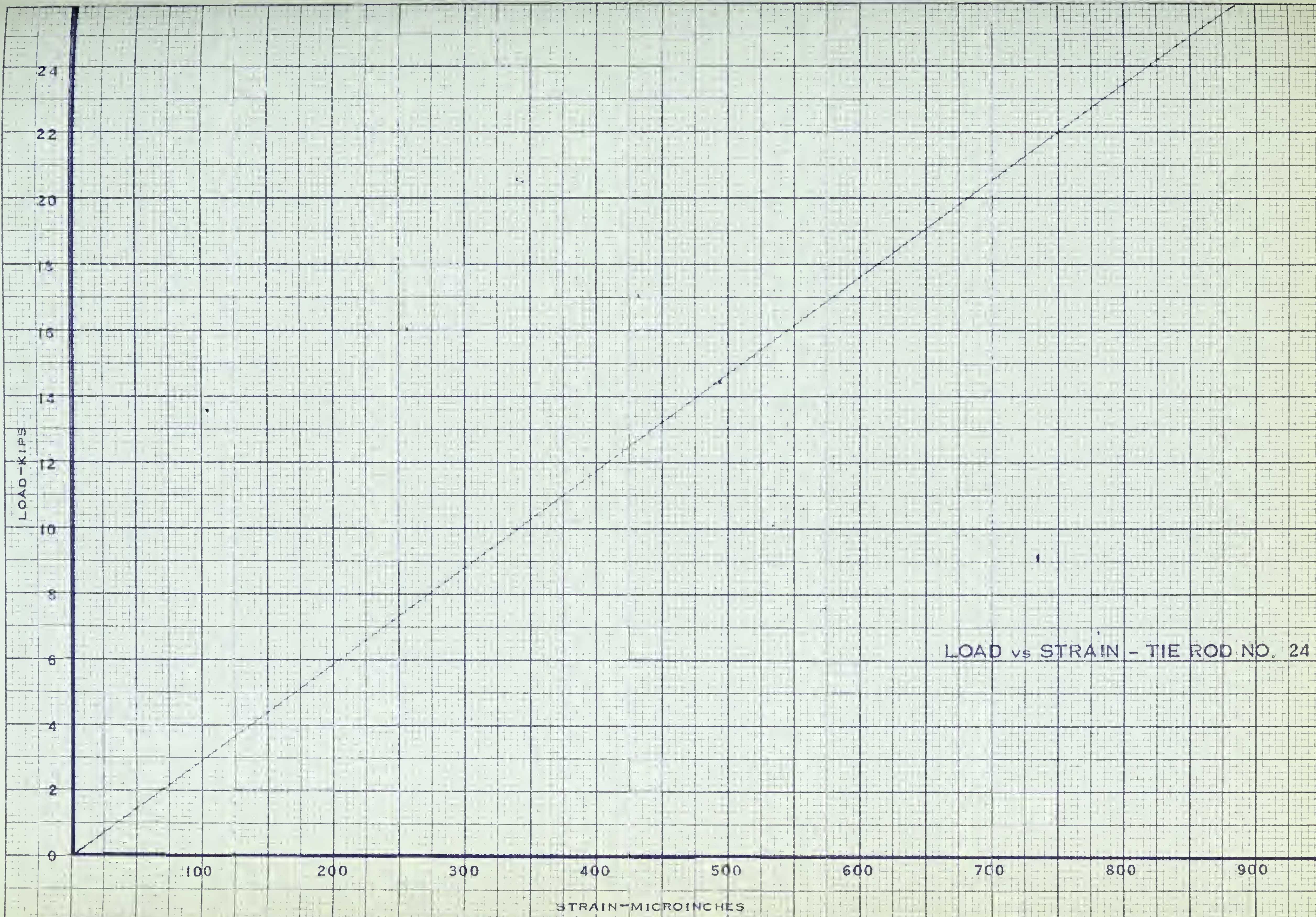
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STRAIN-MICROINCHES
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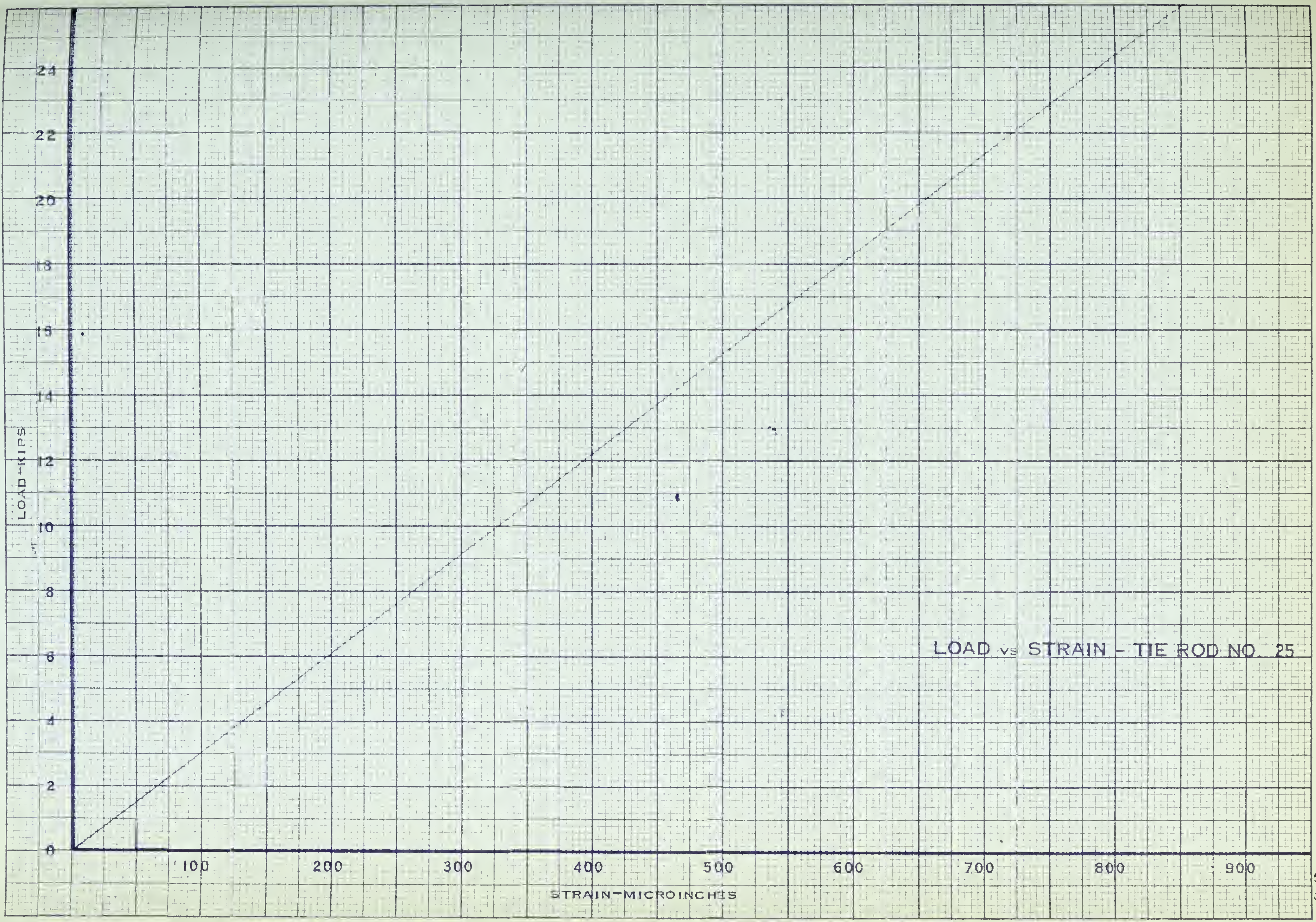
LOAD vs STRAIN - TIE ROD NO. 25
LOAD-KIPS
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24
STRAIN-MICROINCHES
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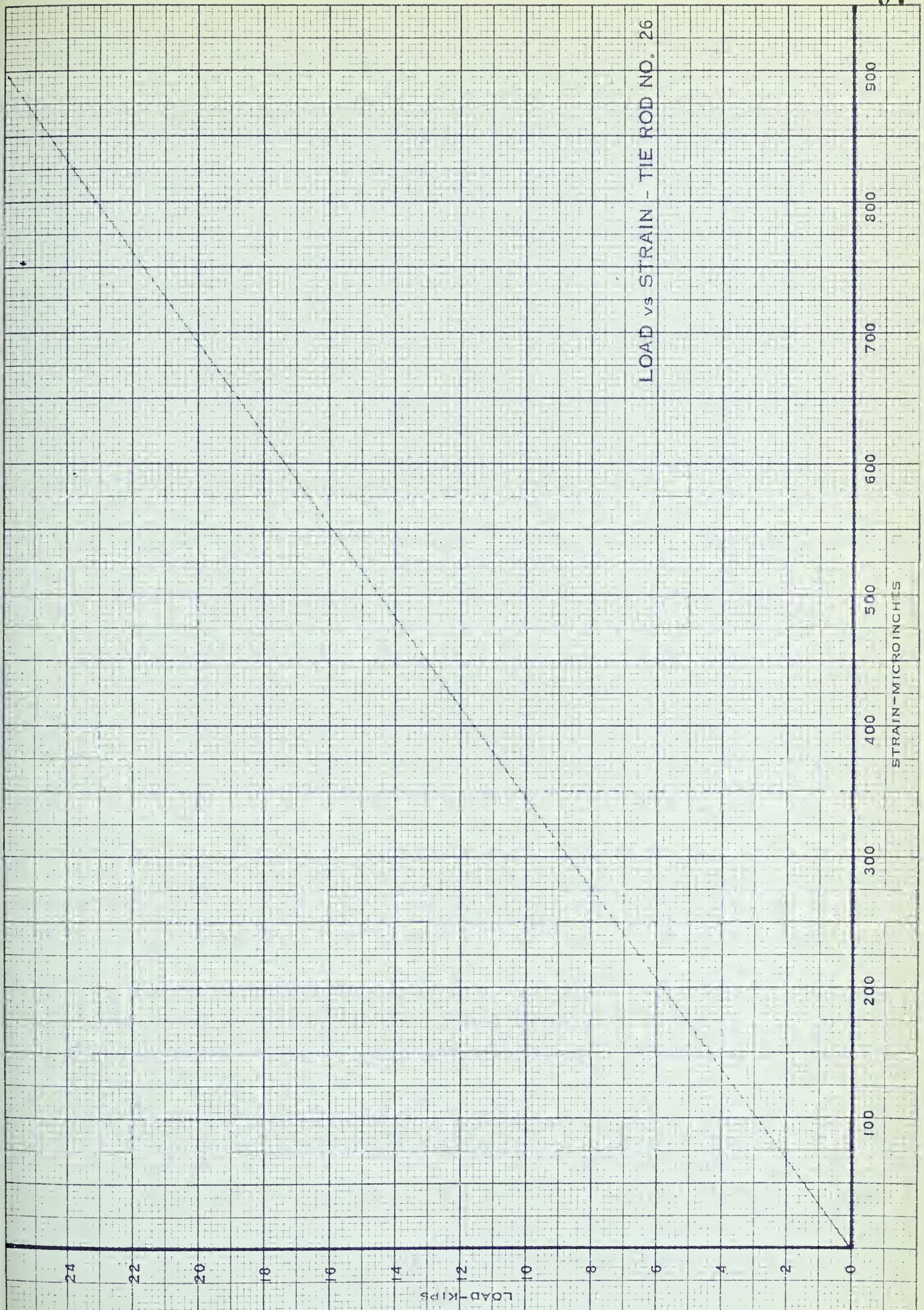

LOAD vs STRAIN - TIE ROD NO. 26
STRAIN-MICROINCHES
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LOAD-KIPS
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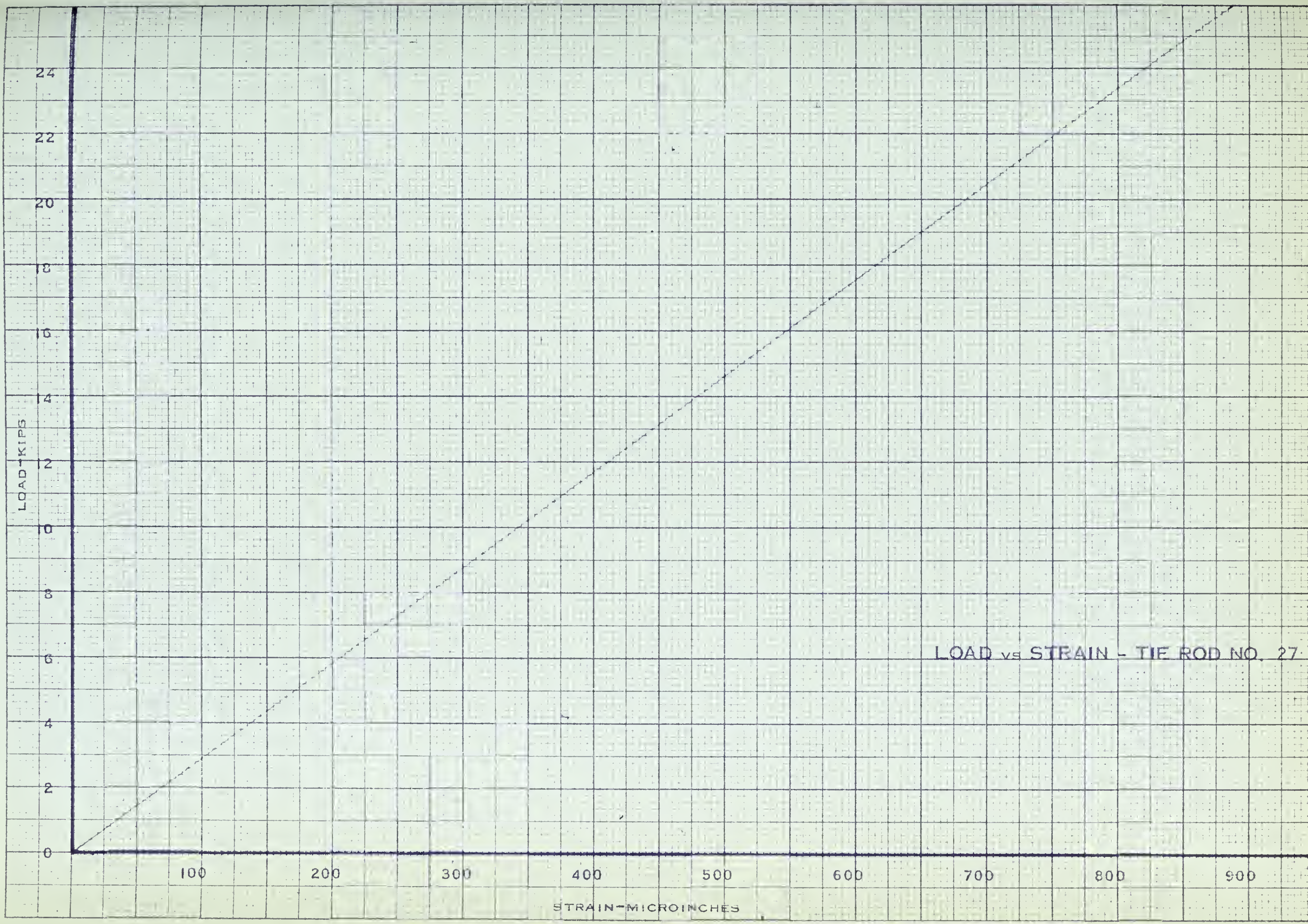
LOAD vs STRAIN - TIE ROD NO. 27
LOAD-KIPS
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24
STRAIN-MICROINCHES
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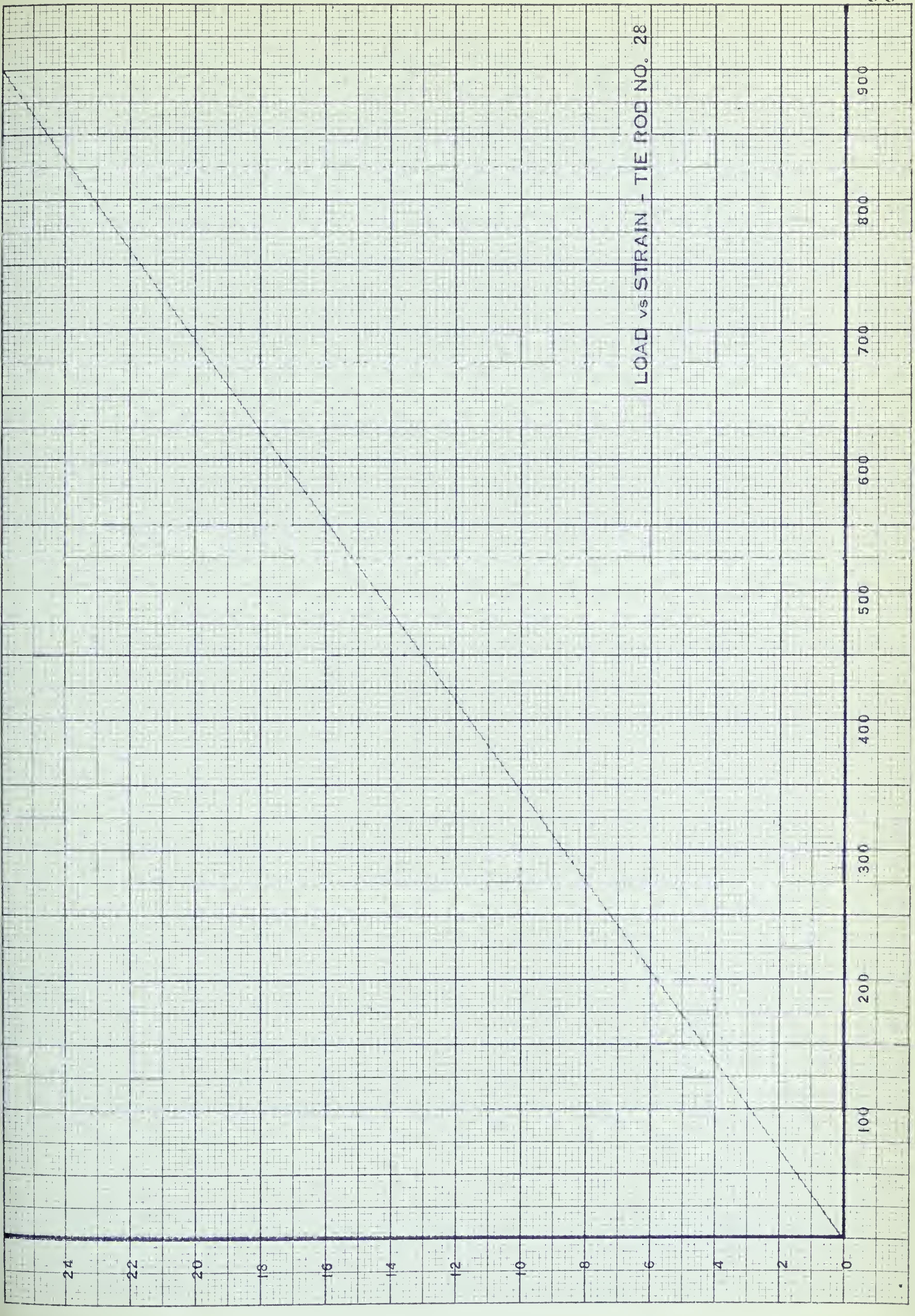
LOAD vs STRAIN - TIE ROD NO. 28
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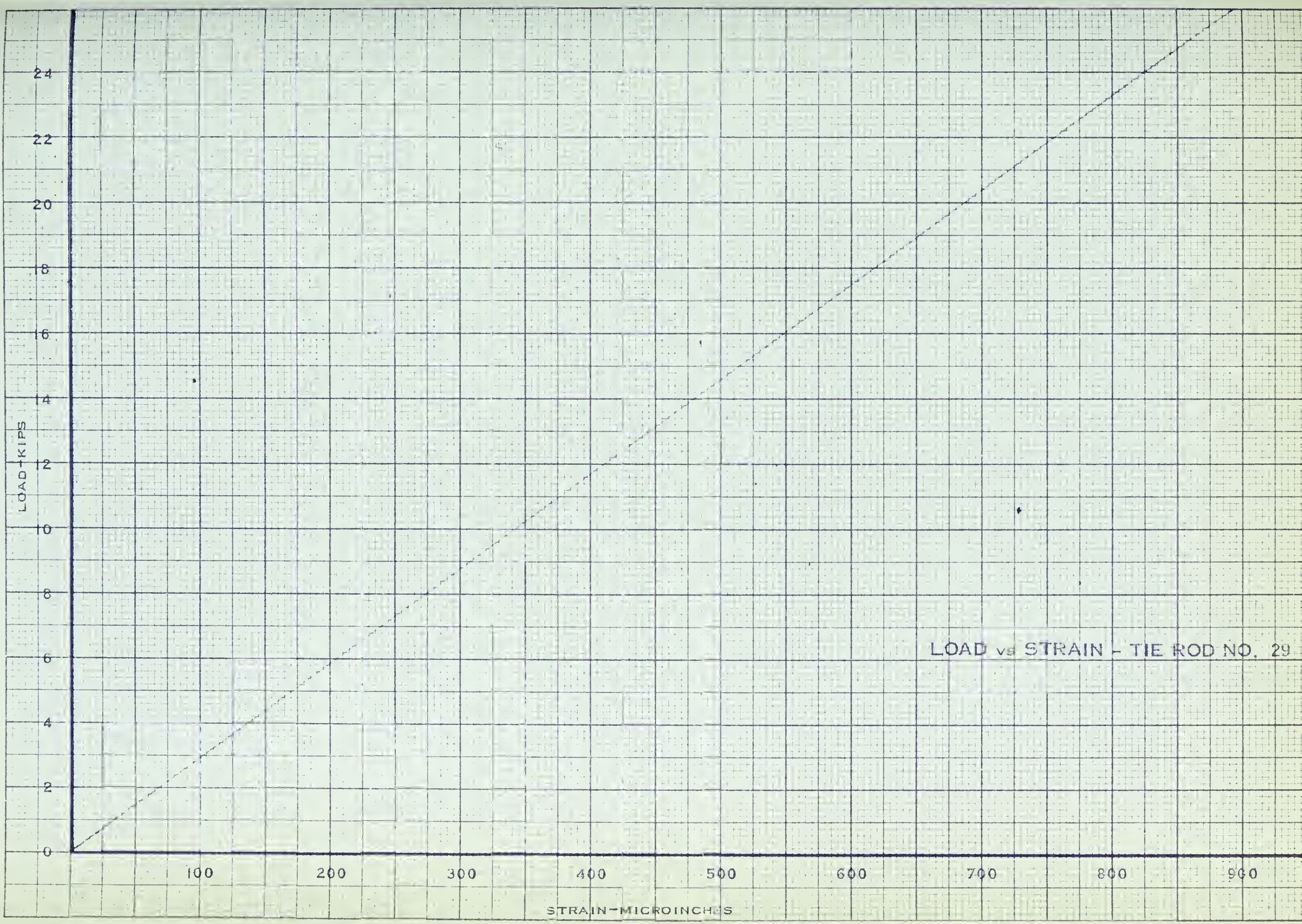
LOAD vs STRAIN - TIE ROD NO. 29
LOAD-KIPS
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24
STRAIN-MICROINCHES
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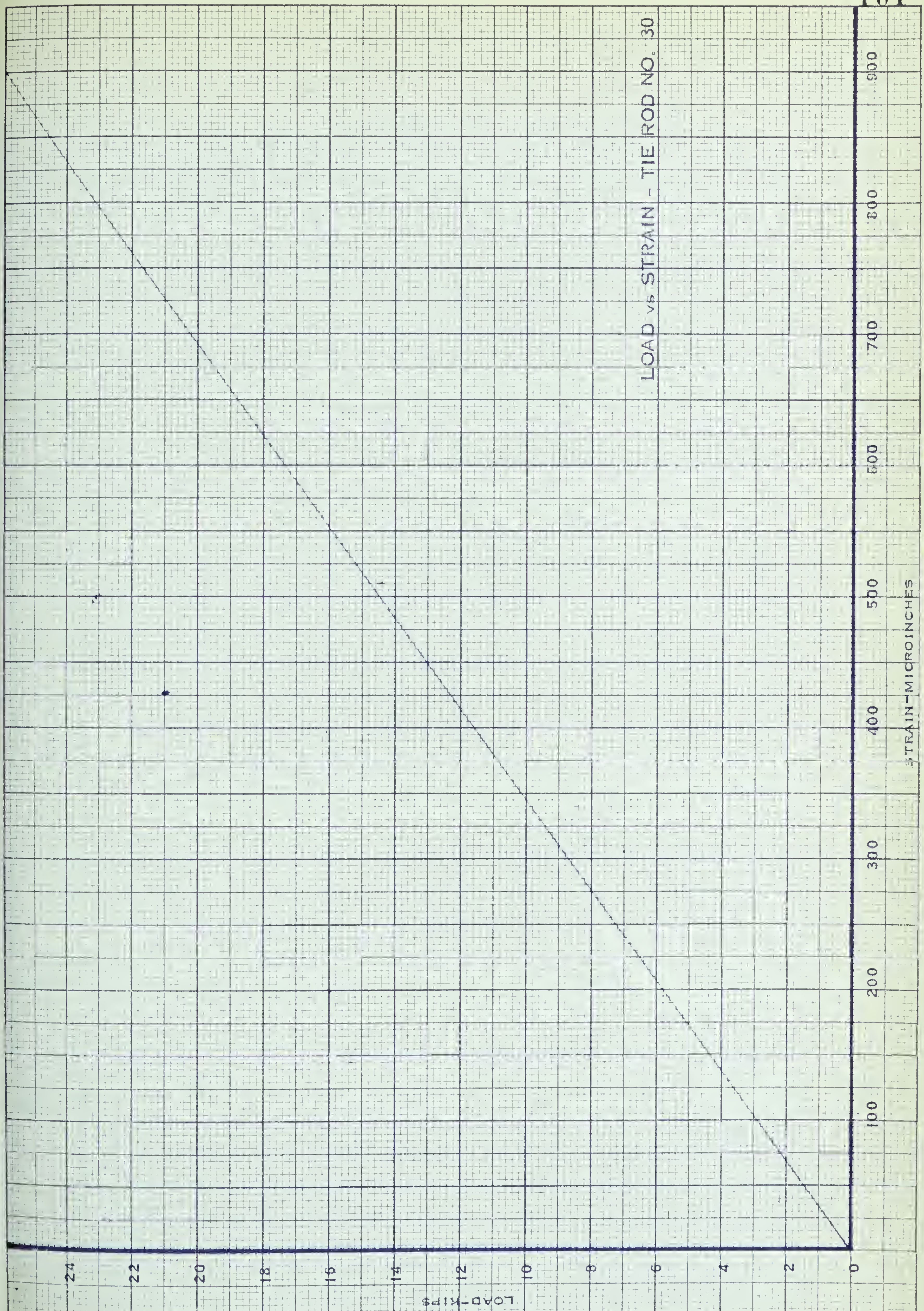
LOAD vs STRAIN - TIE ROD NO. 30
LOAD-KIPS
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24
STRAIN-MICROINCHES
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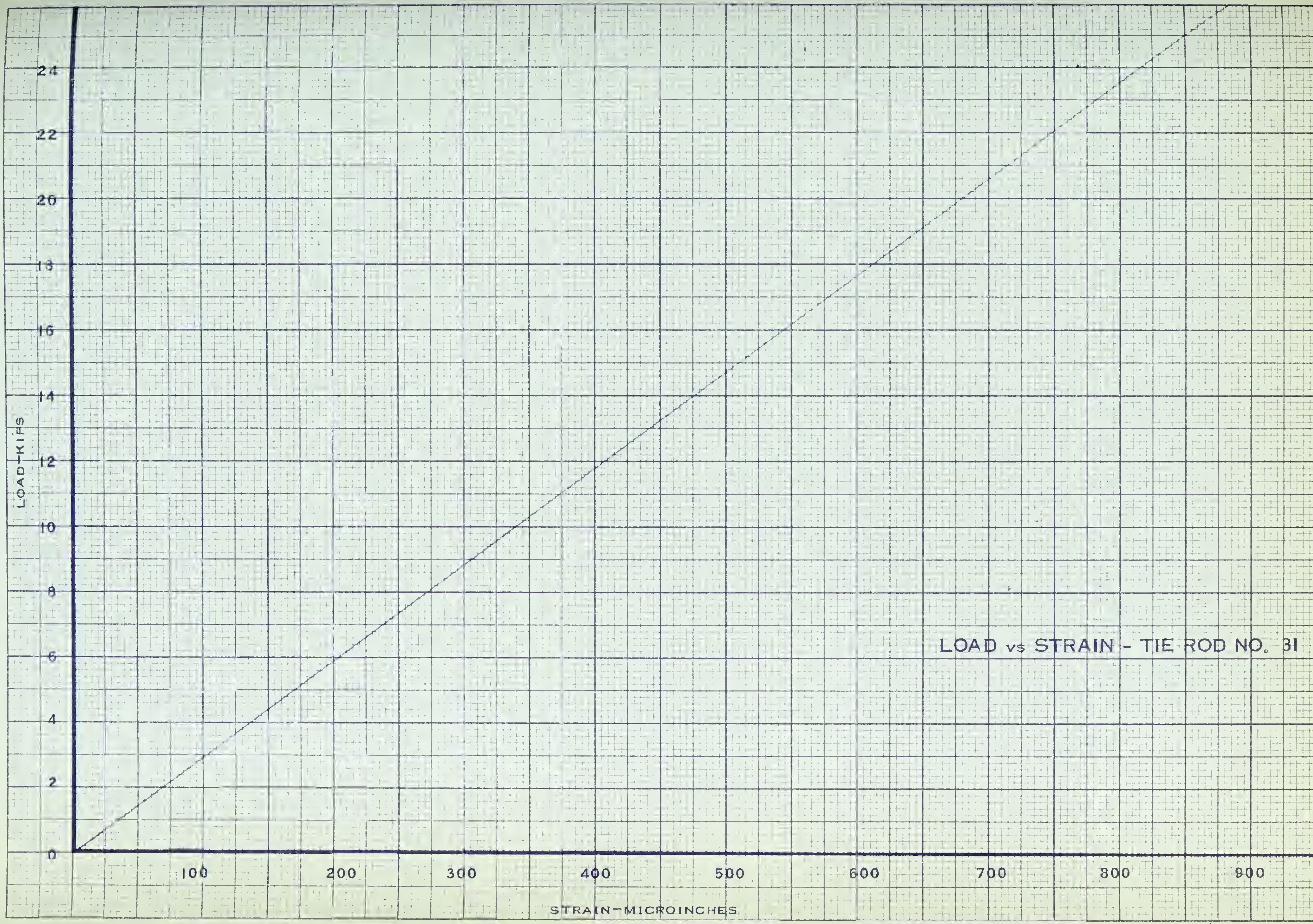
LOAD vs STRAIN - TIE ROD NO. 31
LOAD-KIPS
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22
24
STRAIN-MICROINCHES
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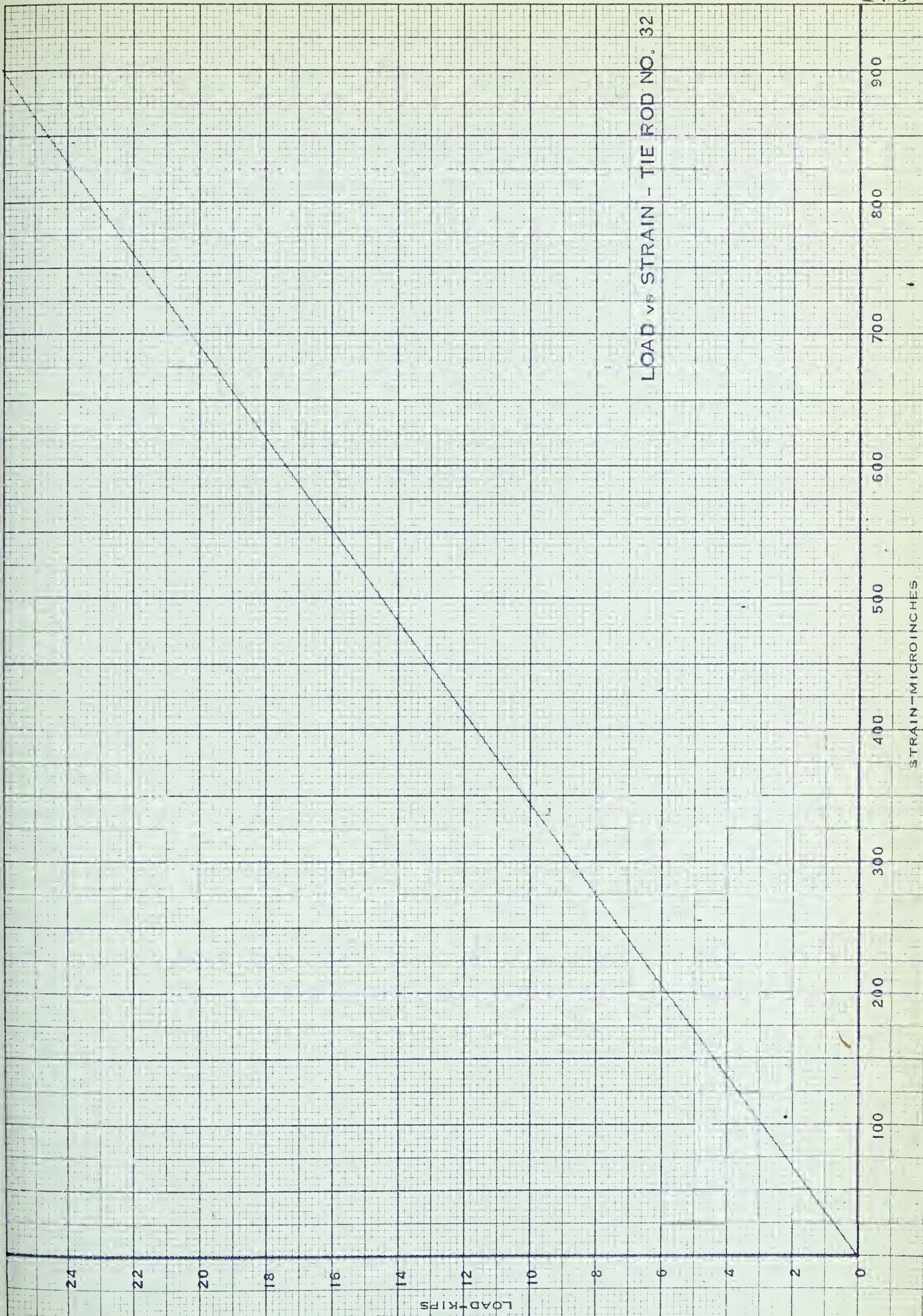
LOAD vs STRAIN - TIE ROD NO. 32
STRAIN-MICROINCHES
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900
LOAD-KIPS
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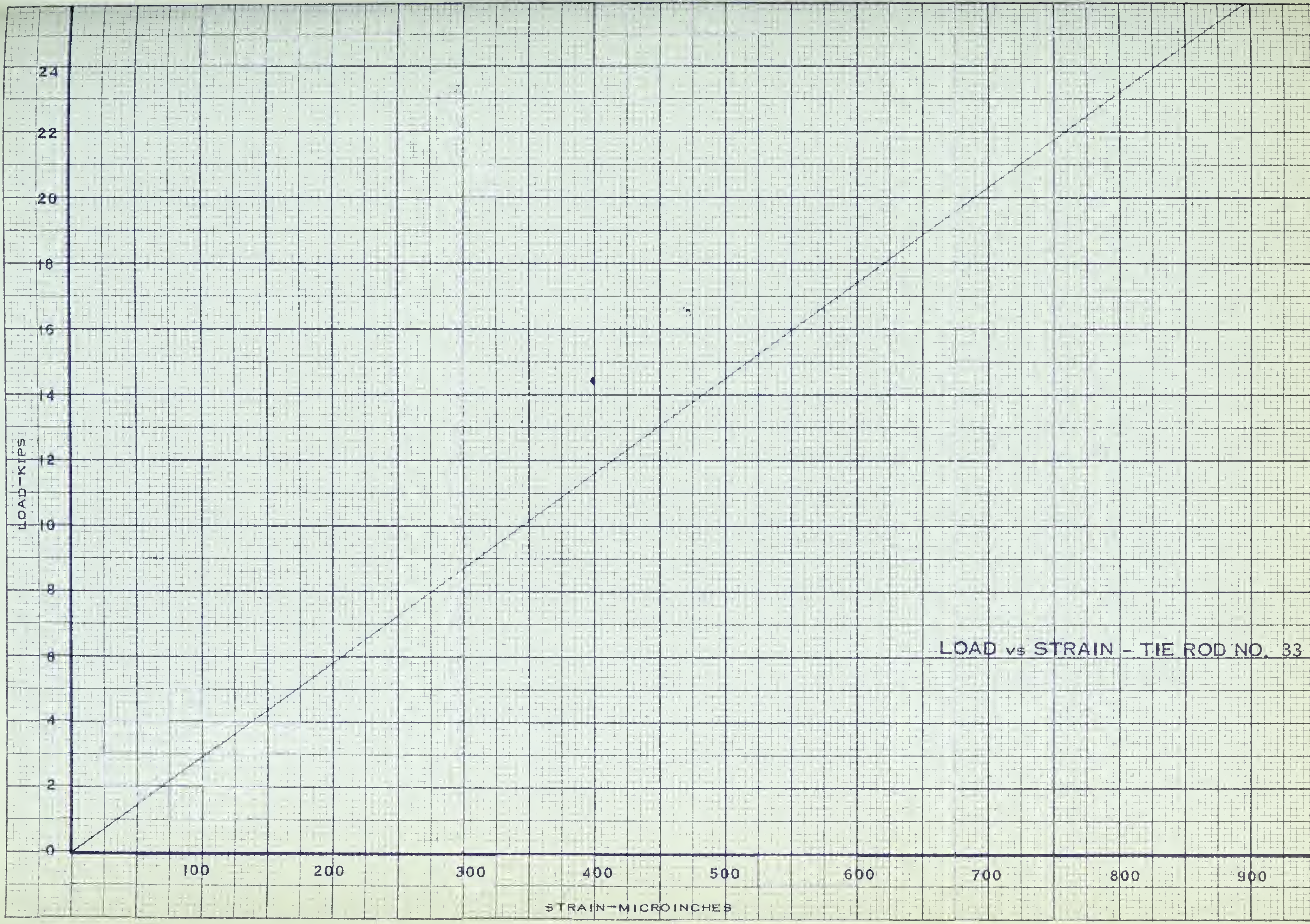
LOAD vs STRAIN - TIE ROD NO. 33
LOAD-KIPS
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STRAIN-MICROINCHES
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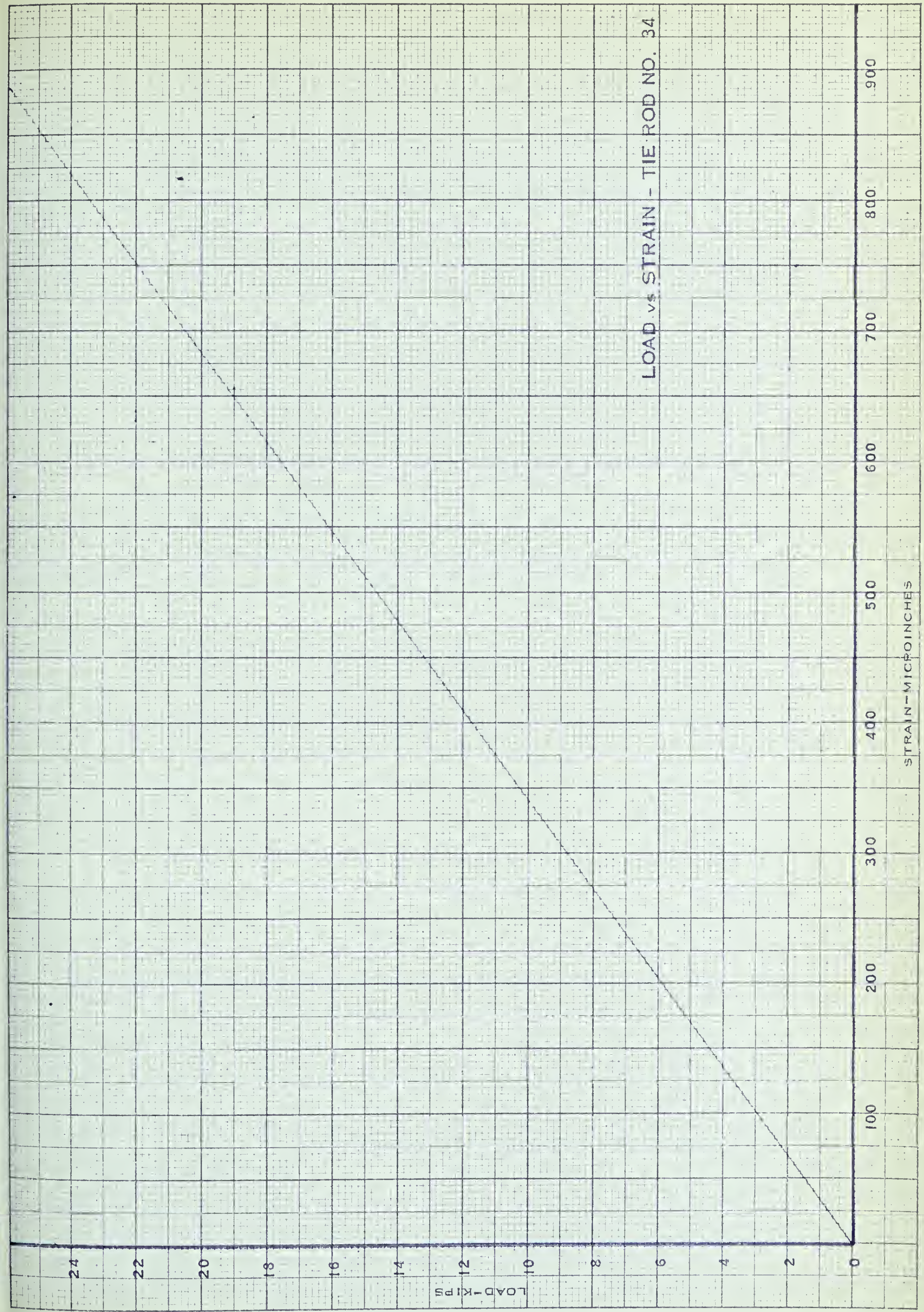
LOAD vs STRAIN - TIE ROD NO. 34
STRAIN-MICROINCHES
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LOAD-KIPS
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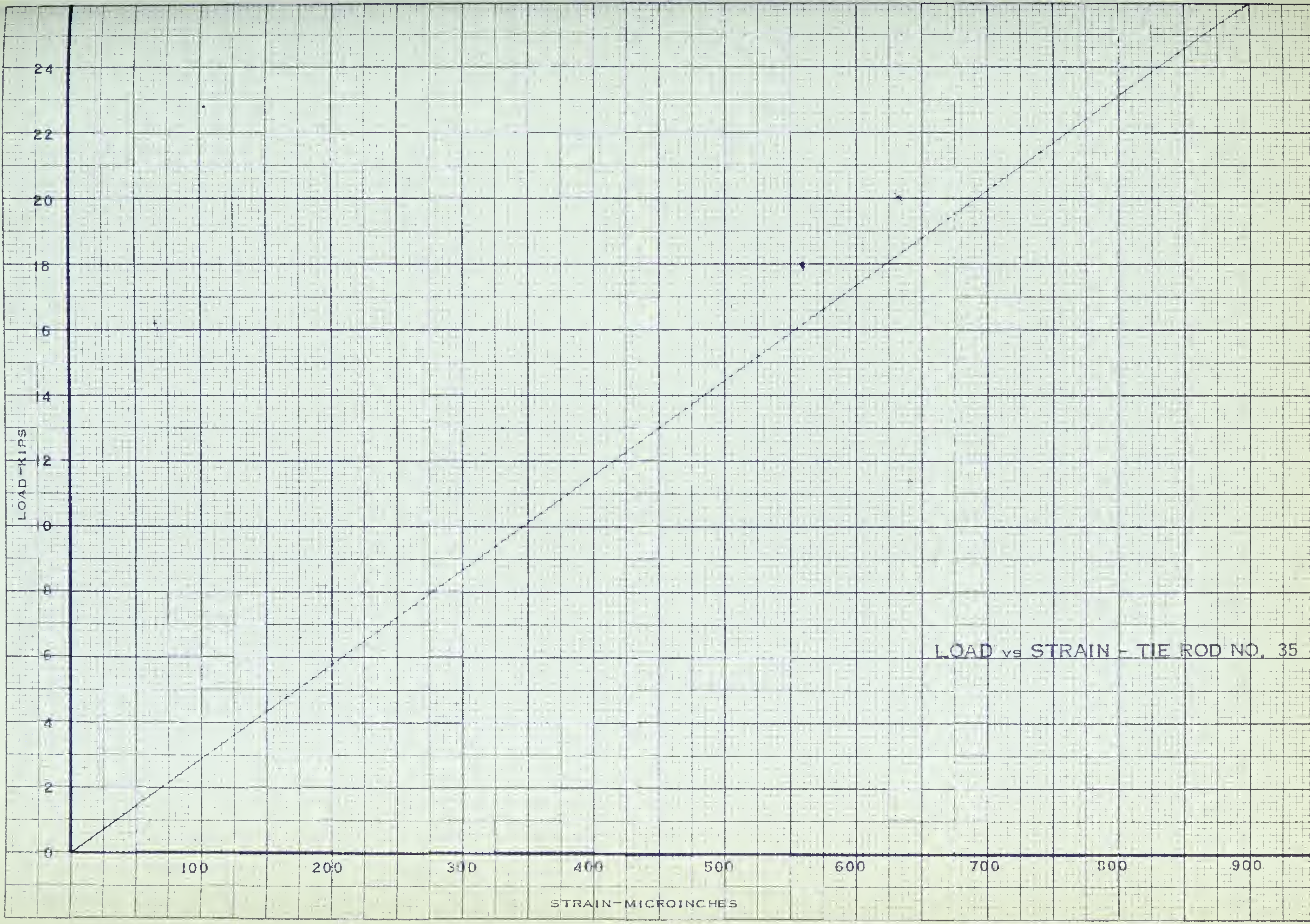
LOAD vs STRAIN - TIE ROD NO. 35
LOAD-KIPS
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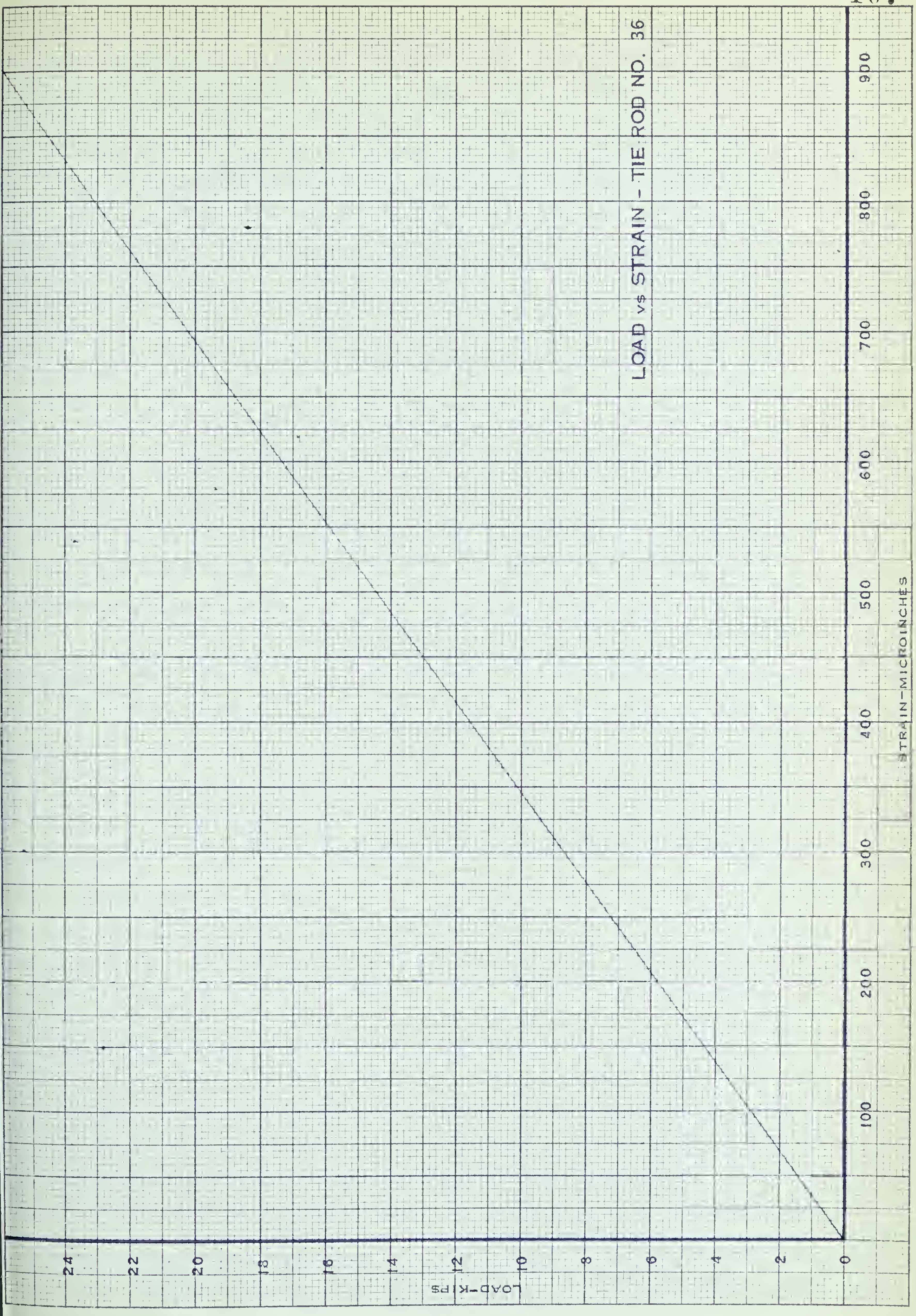
STRAIN-MICROINCHES


LOAD vs STRAIN - TIE ROD NO. 36
STRAIN-MICROINCHES
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LOAD-KIPS
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22
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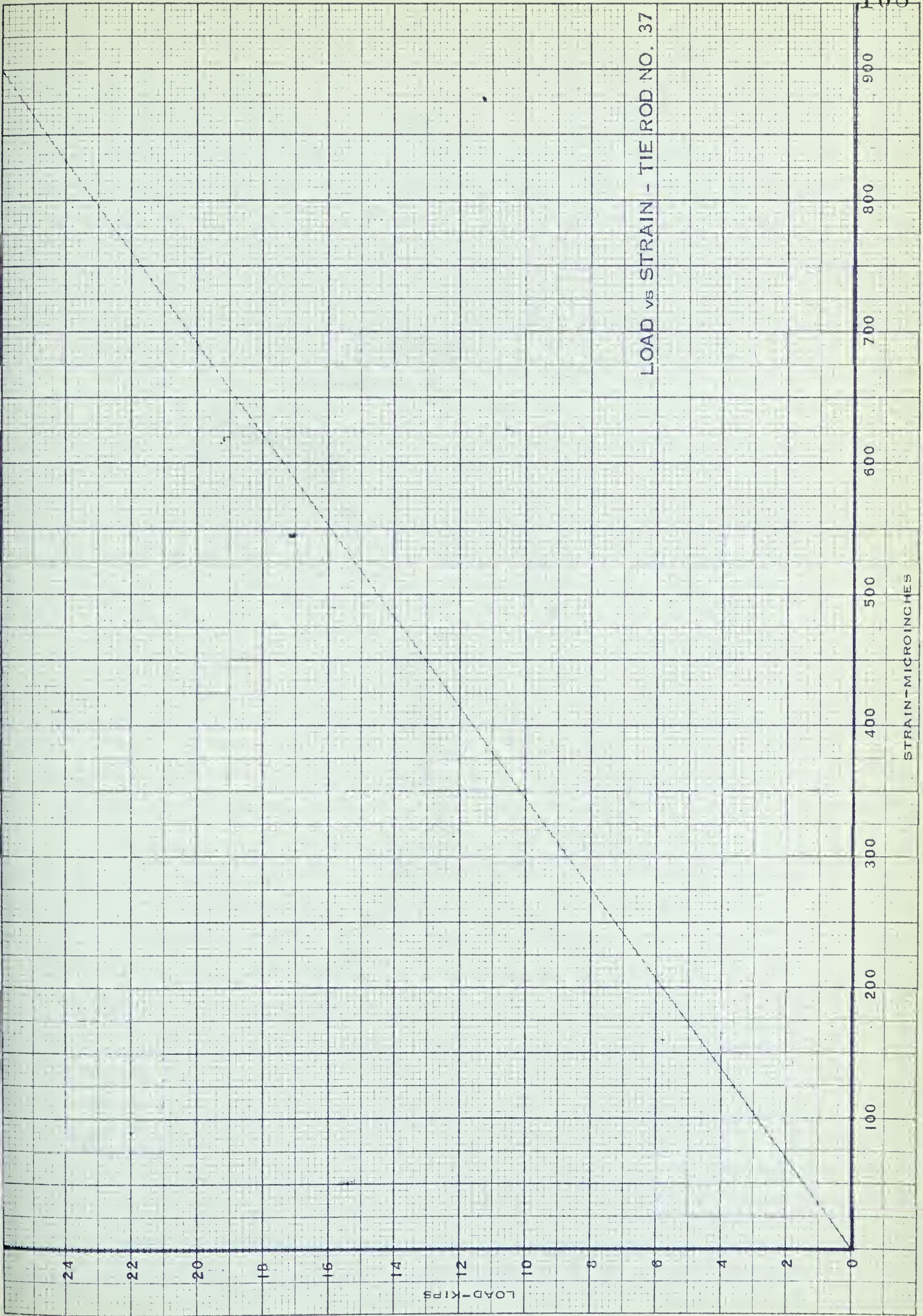
LOAD vs STRAIN - TIE ROD NO. 37
STRAIN-MICROINCHES
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LOAD-KIPS
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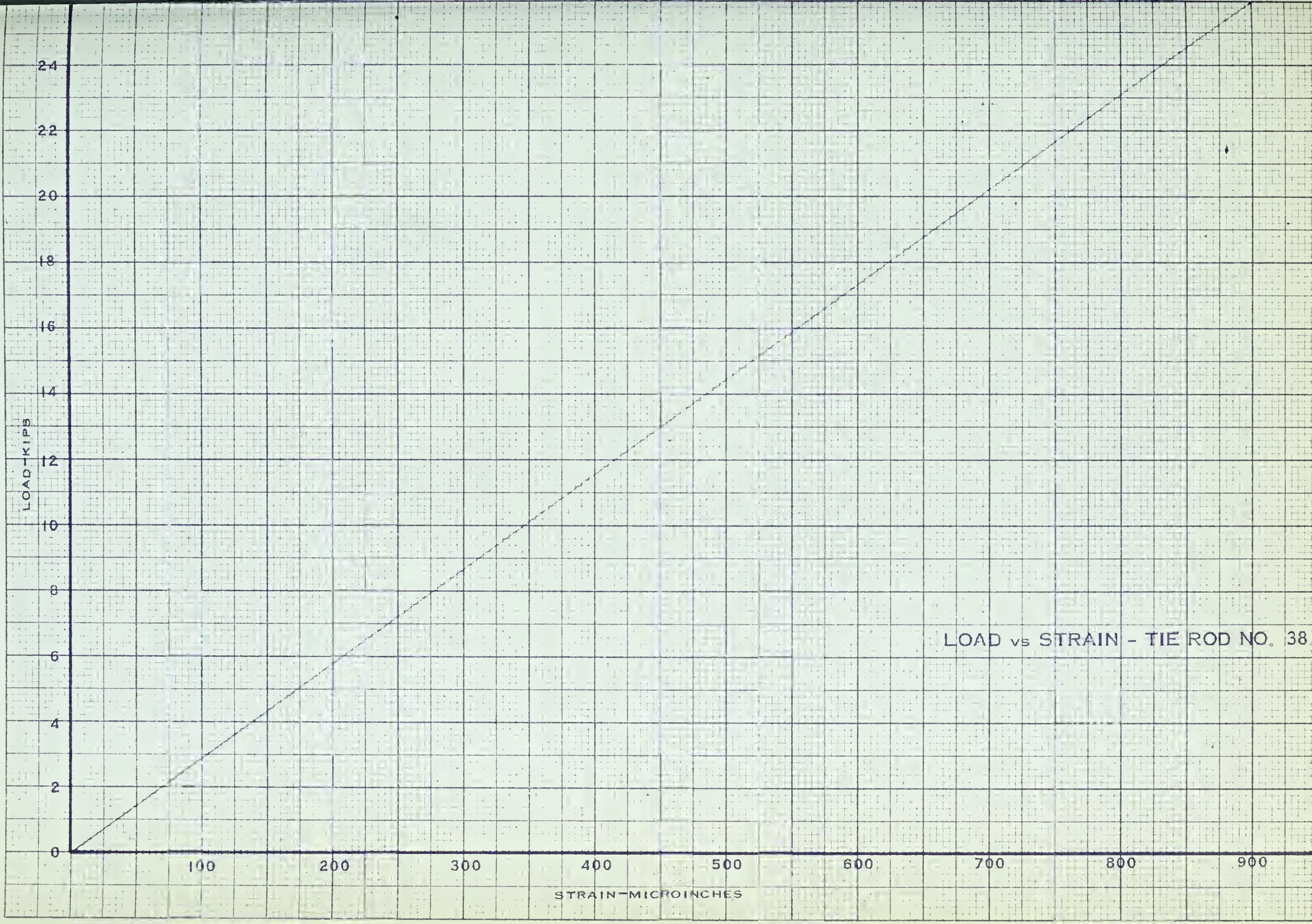
LOAD vs STRAIN - TIE ROD NO. 38
LOAD-KIPS
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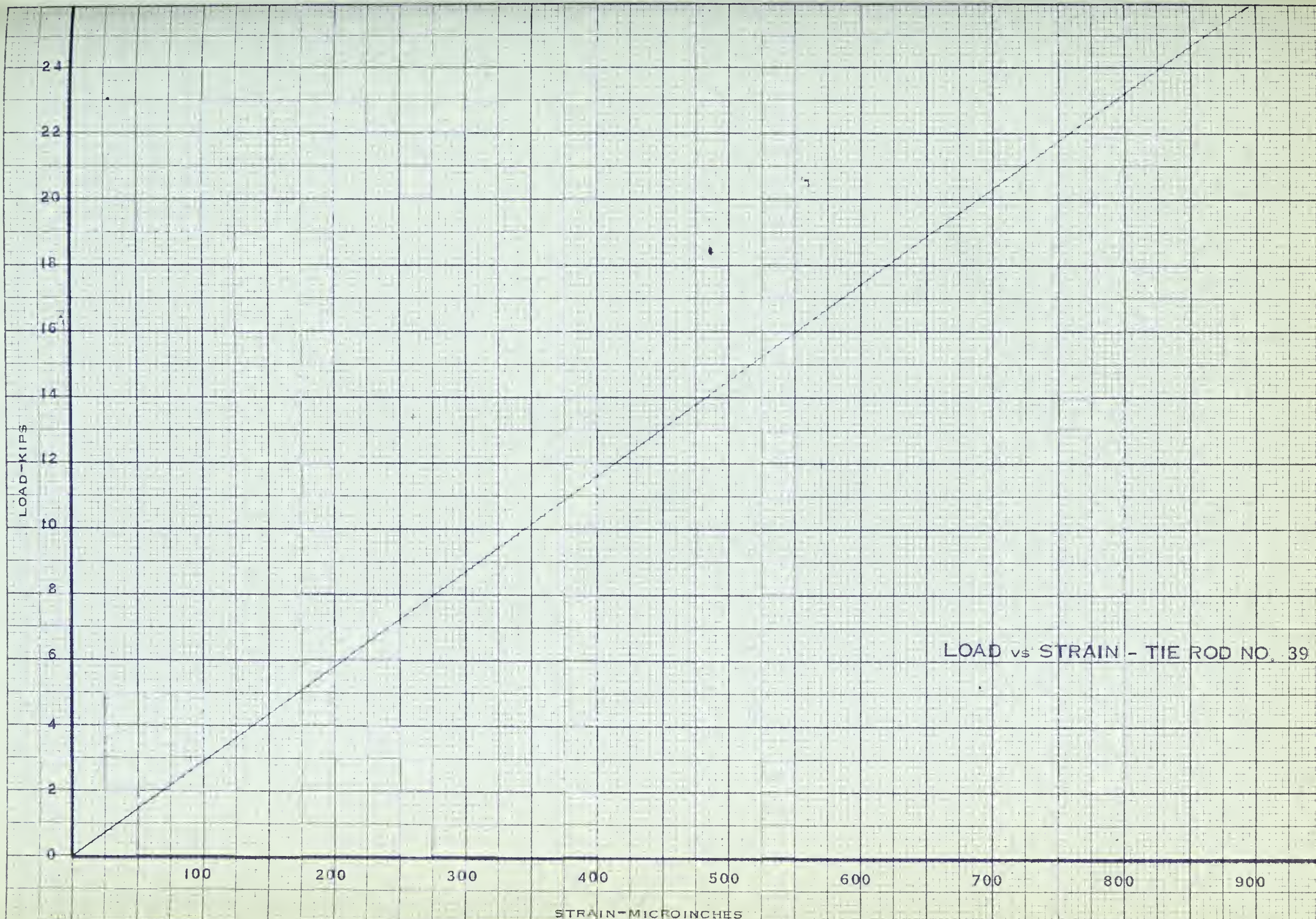
LOAD vs STRAIN - TIE ROD NO. 39
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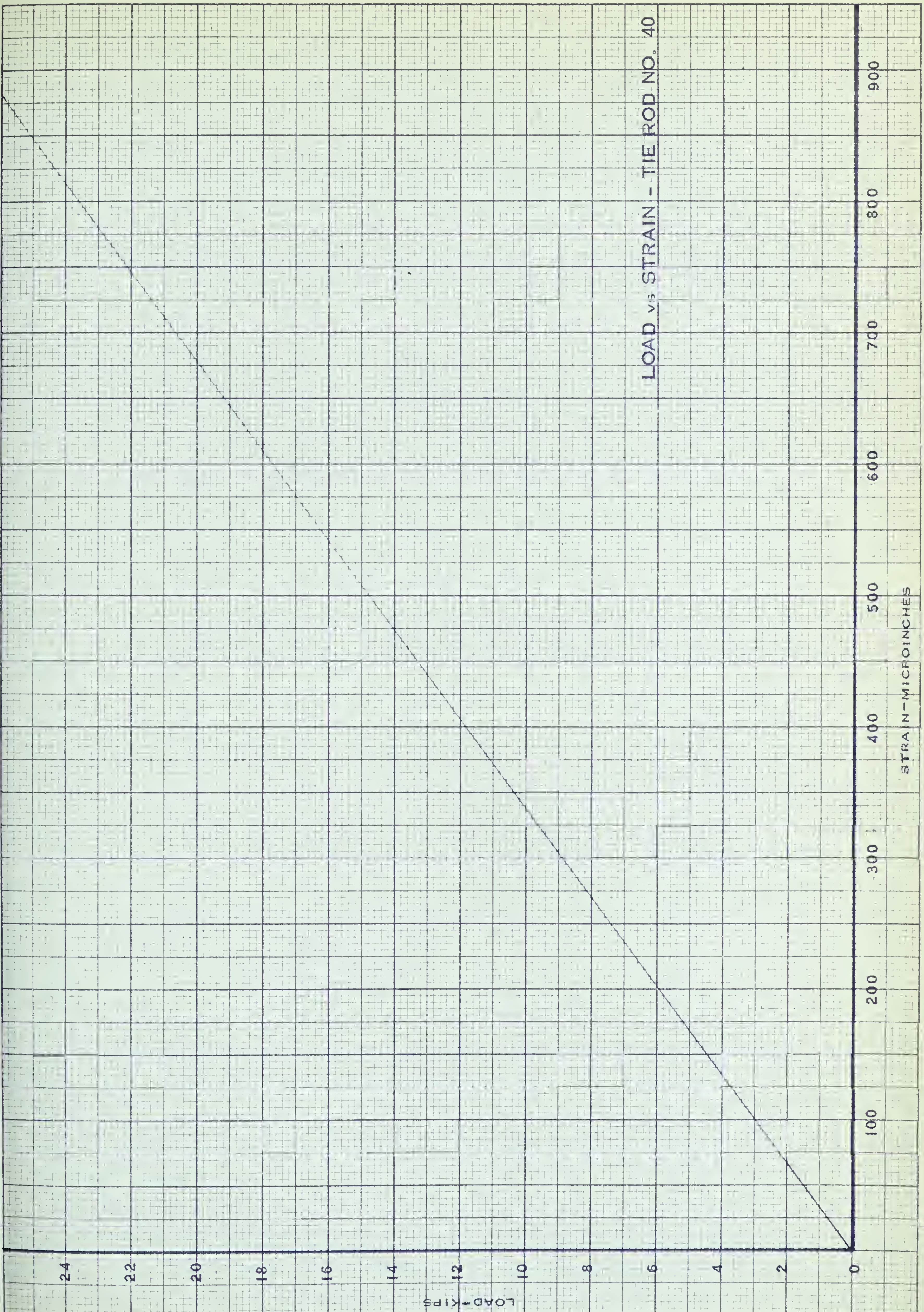
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LOAD-KIPS
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22
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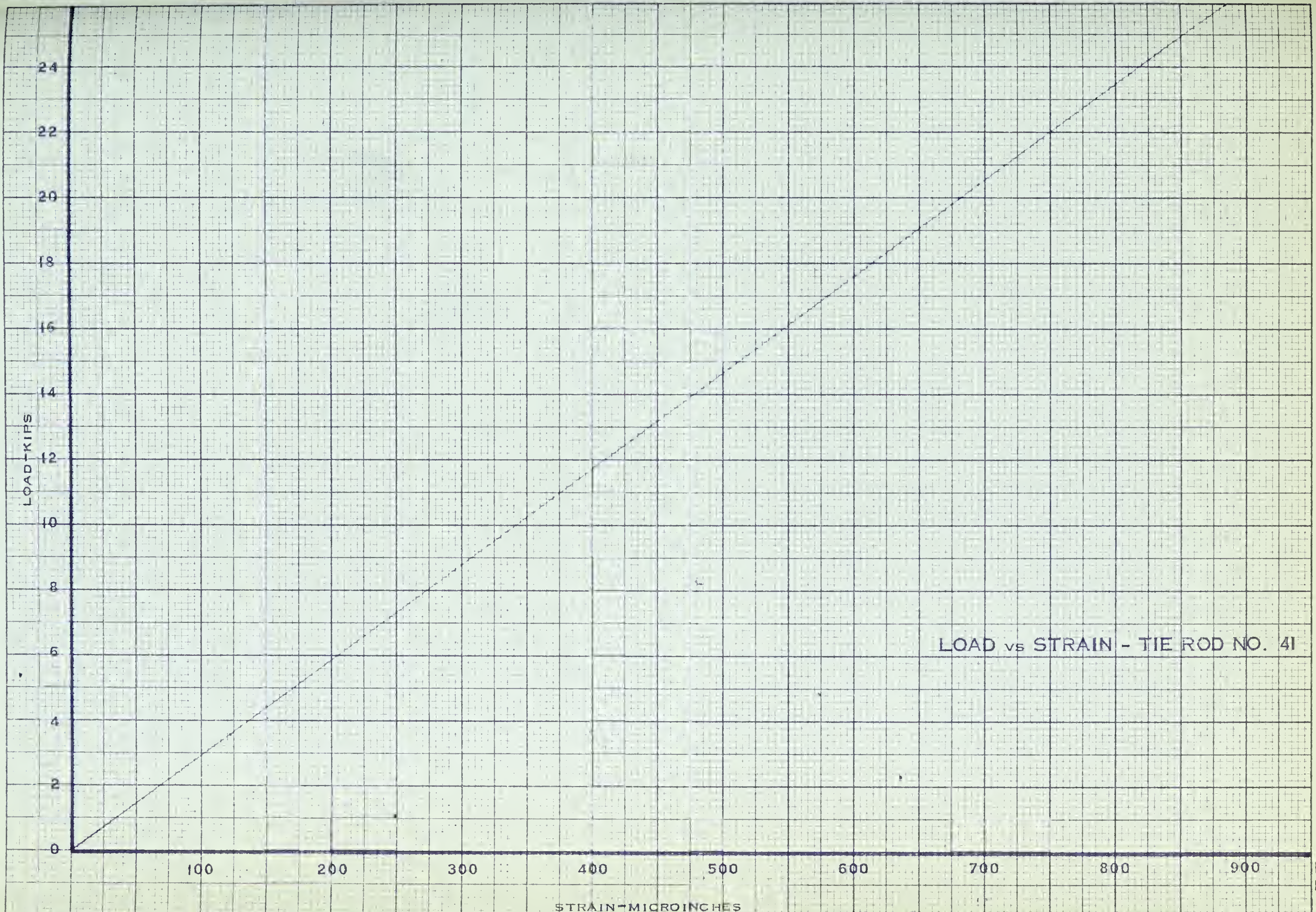
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LOAD-KIPS
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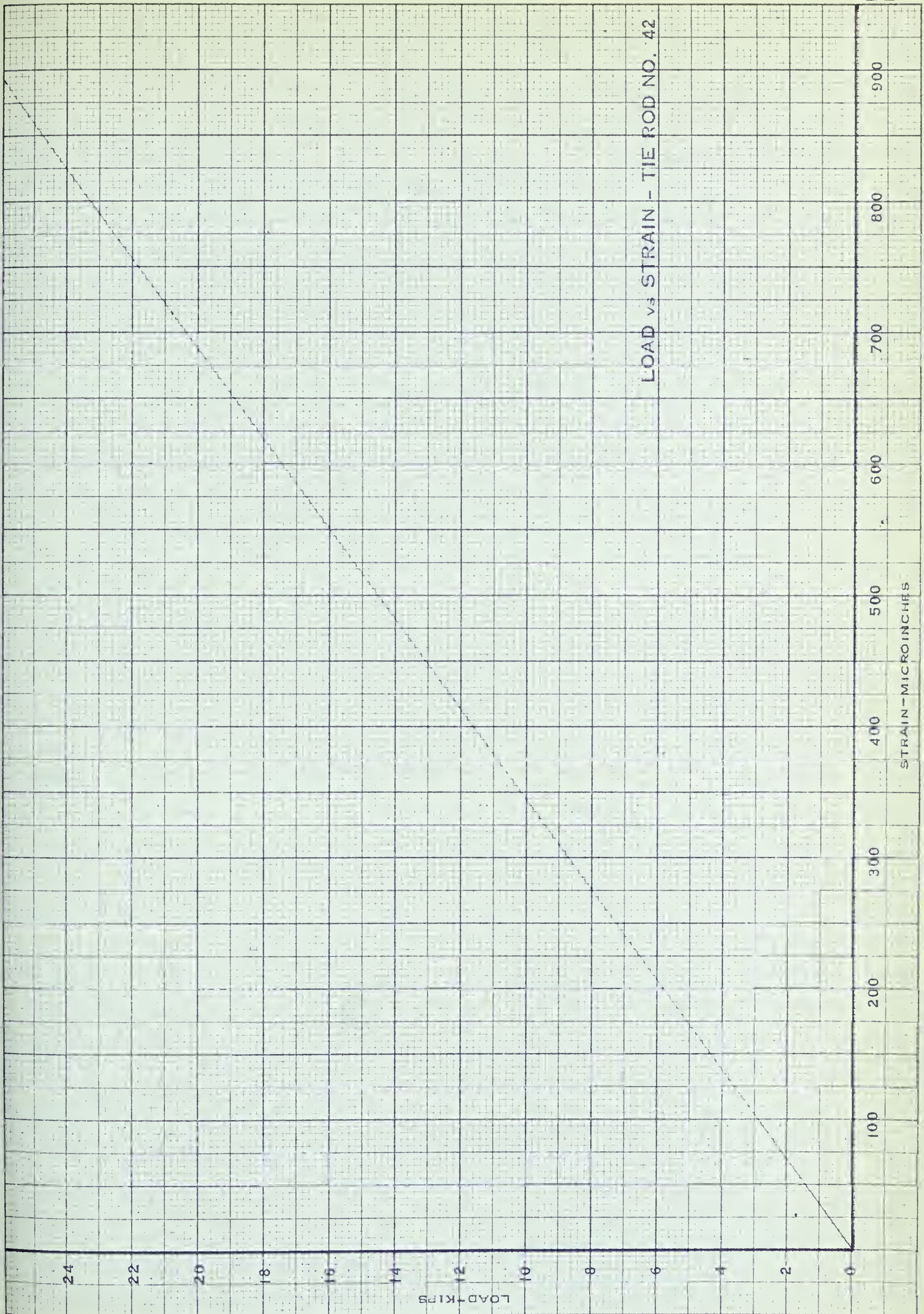
LOAD vs STRAIN - TIE ROD NO. 42
STRAIN-MICROINCHES
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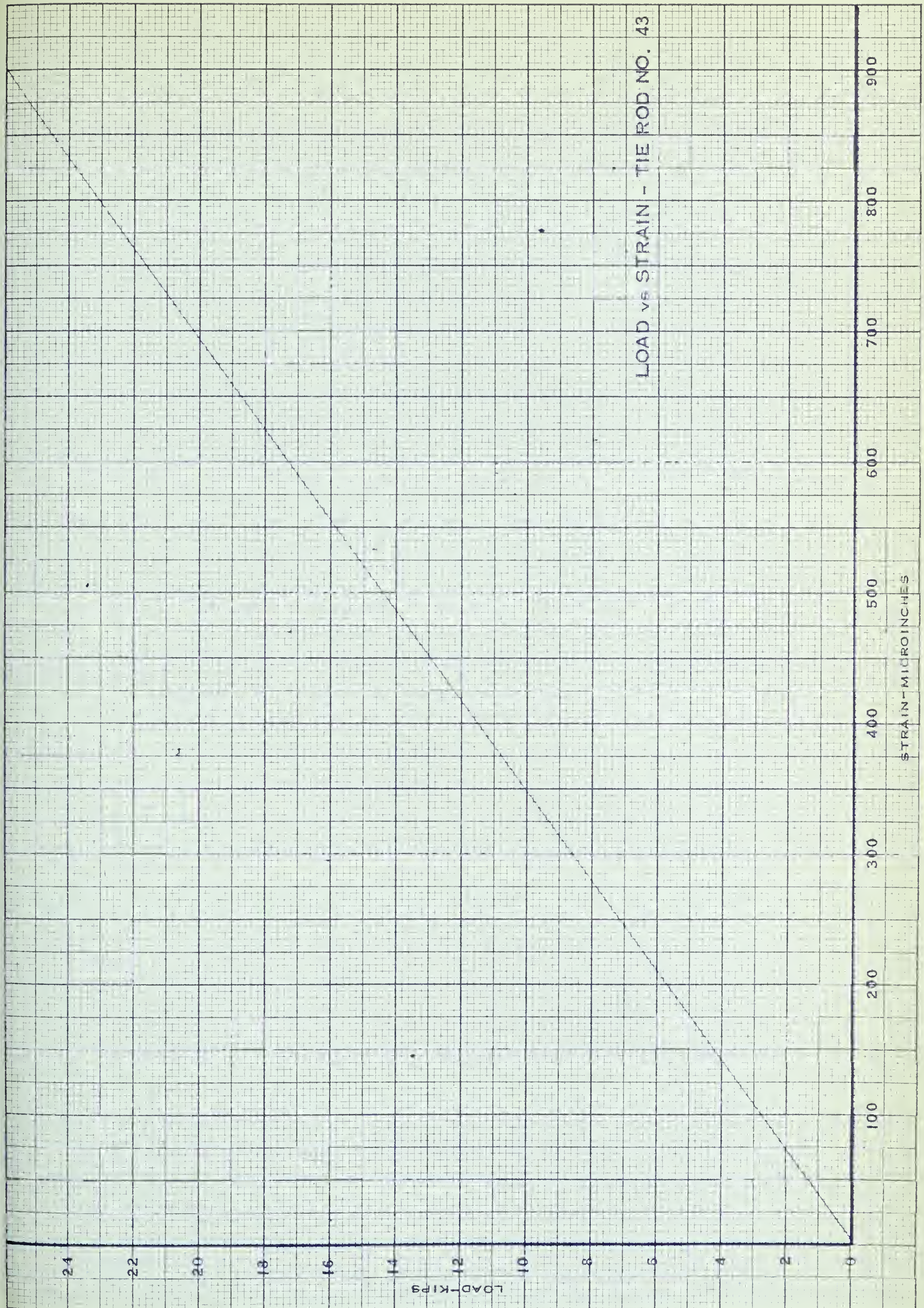
LOAD vs STRAIN - TIE ROD NO. 43
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LOAD-KIPS
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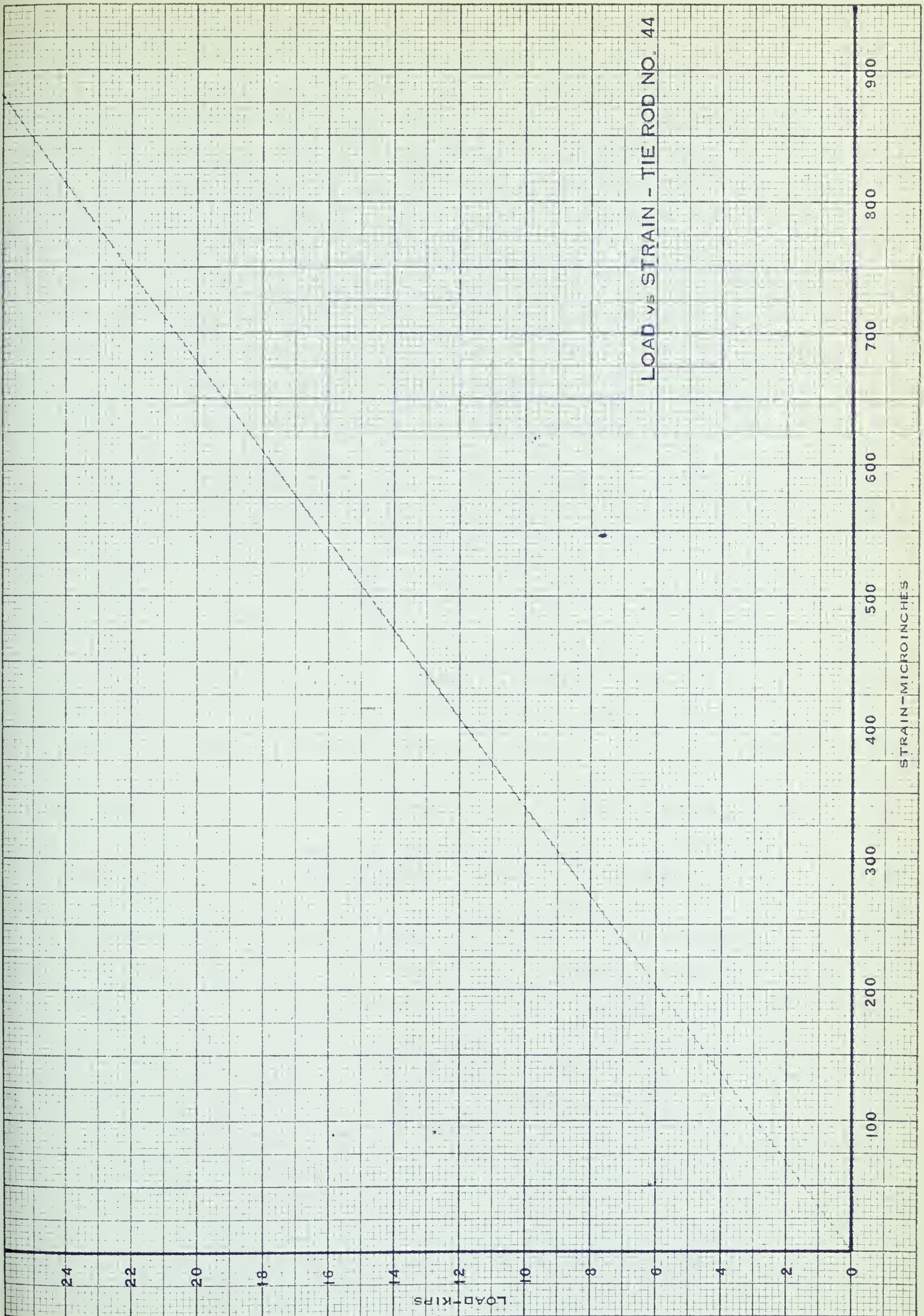
LOAD vs STRAIN - TIE ROD NO. 44
STRAIN-MICROINCHES
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LOAD-KIPS
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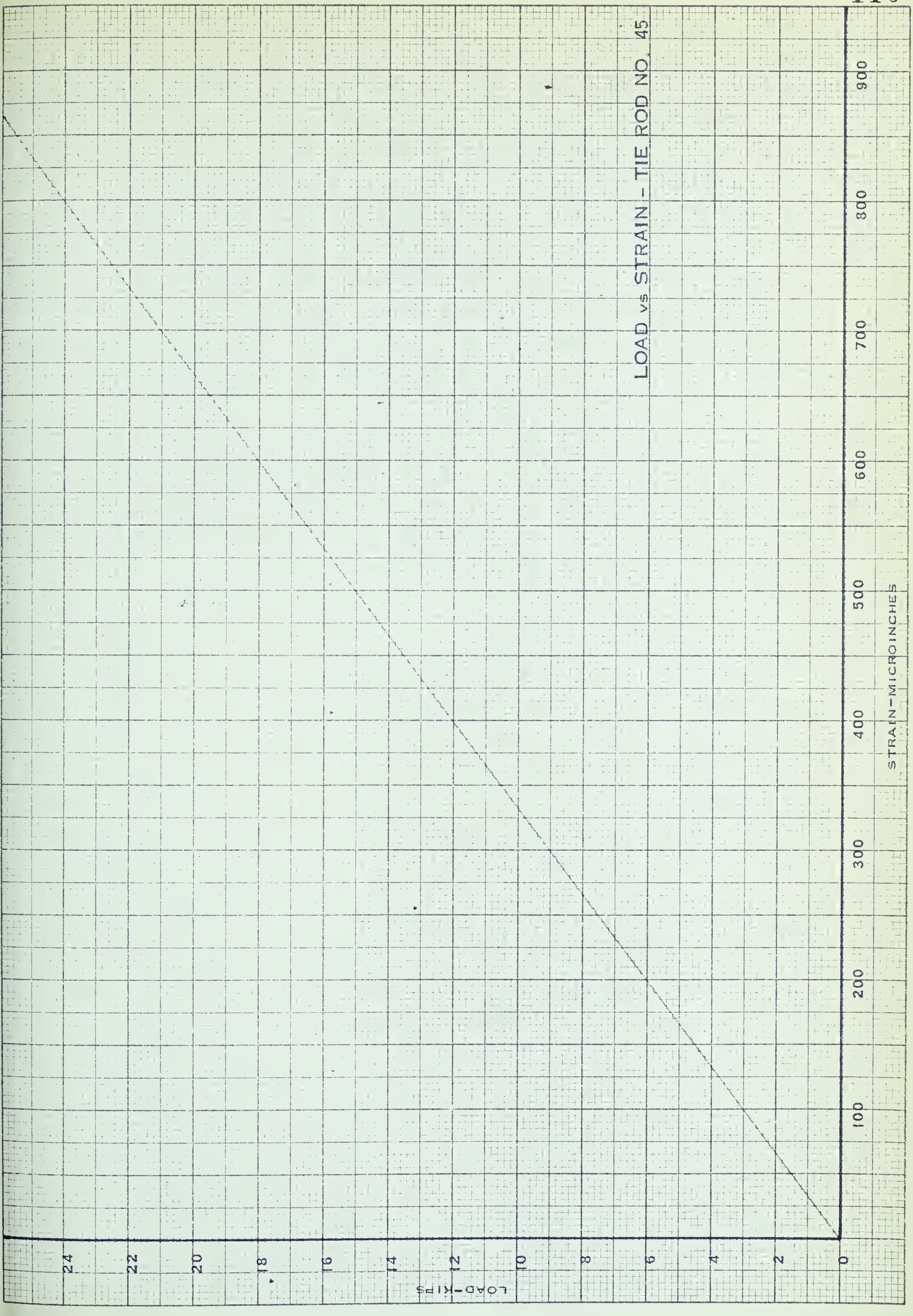
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STRAIN-MICROINCHES
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LOAD-KIPS
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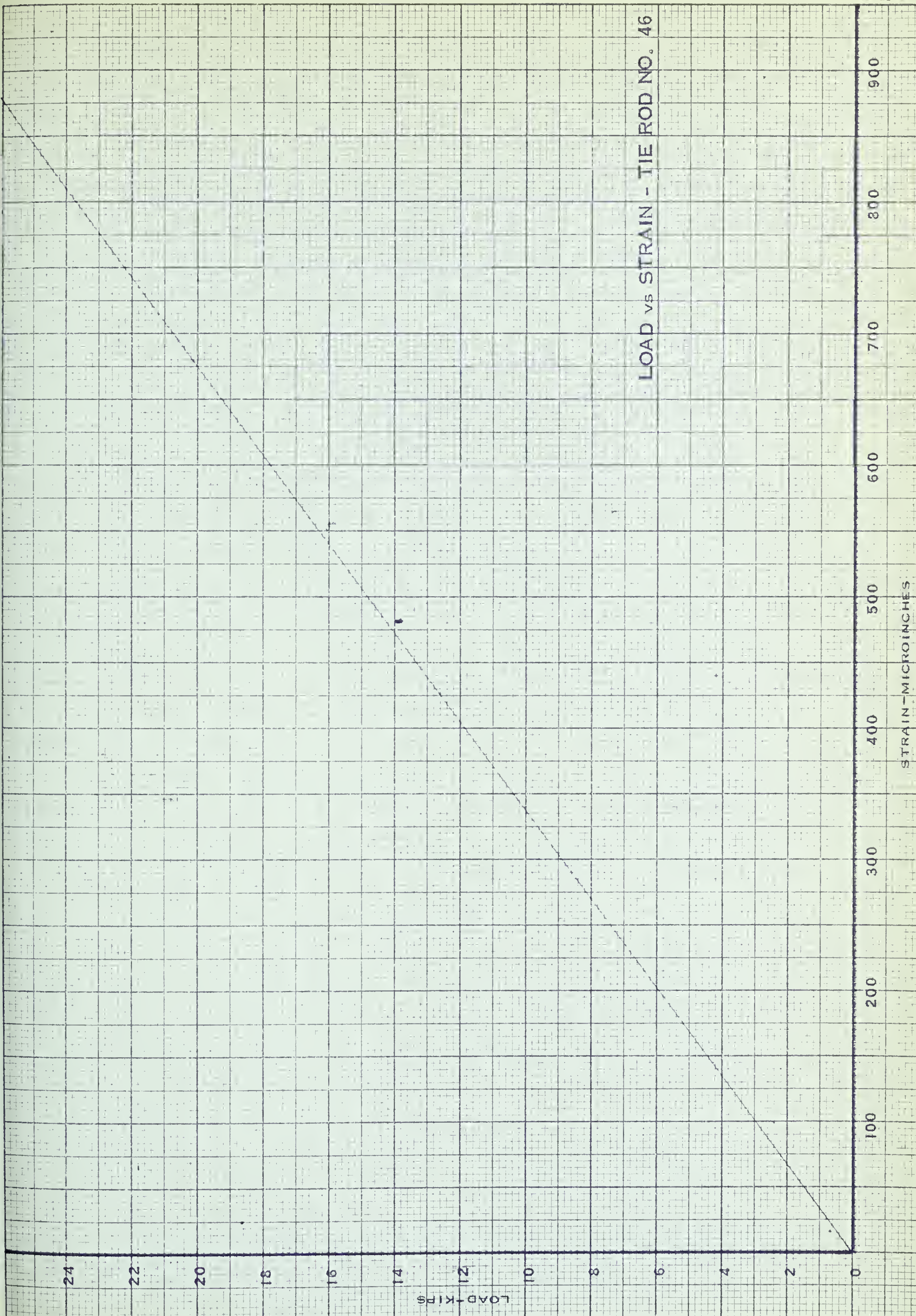
LOAD vs STRAIN - TIE ROD NO. 46
STRAIN-MICROINCHES
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LOAD-KIPS
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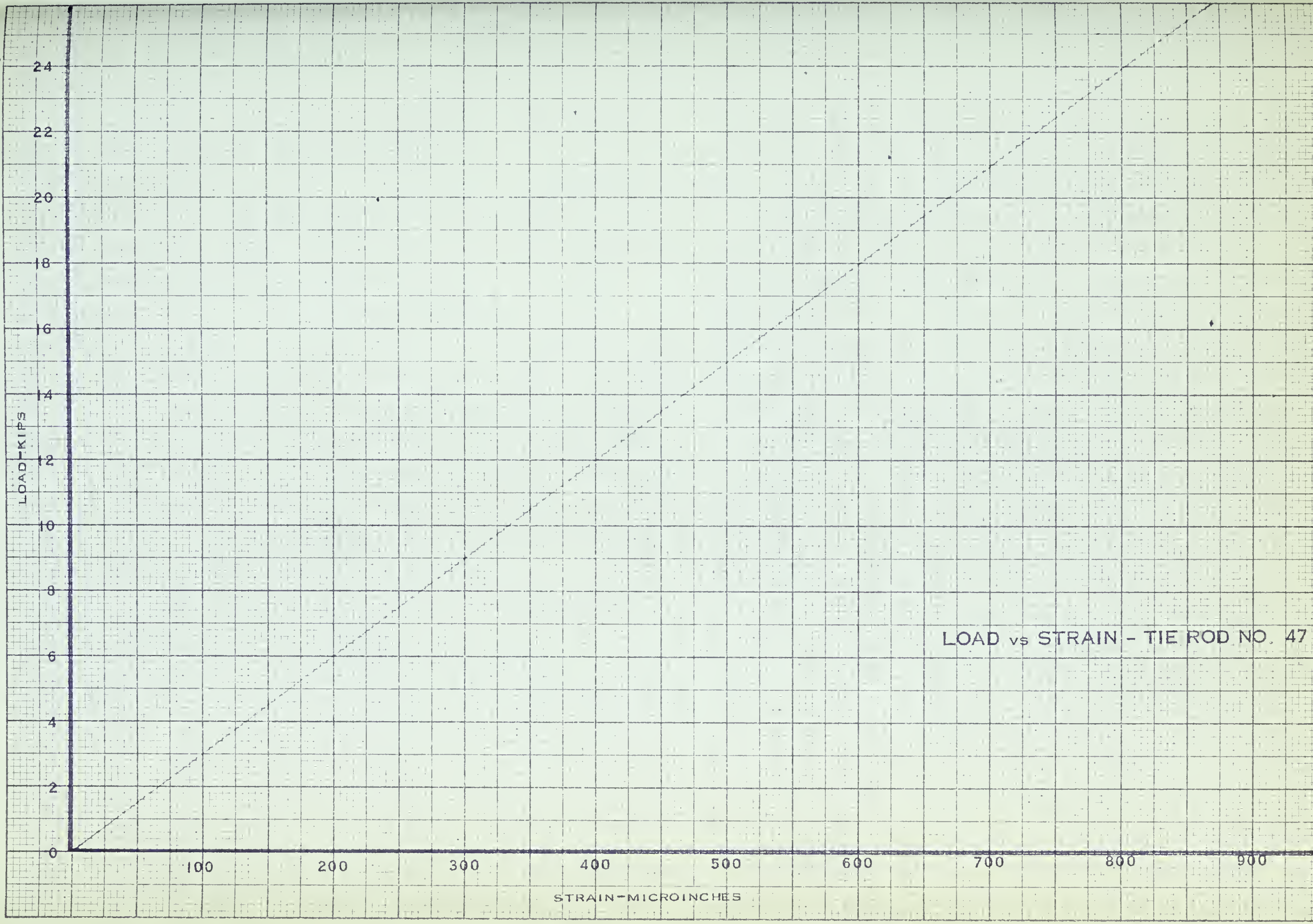
LOAD vs STRAIN - TIE ROD NO. 47
LOAD-KIPS
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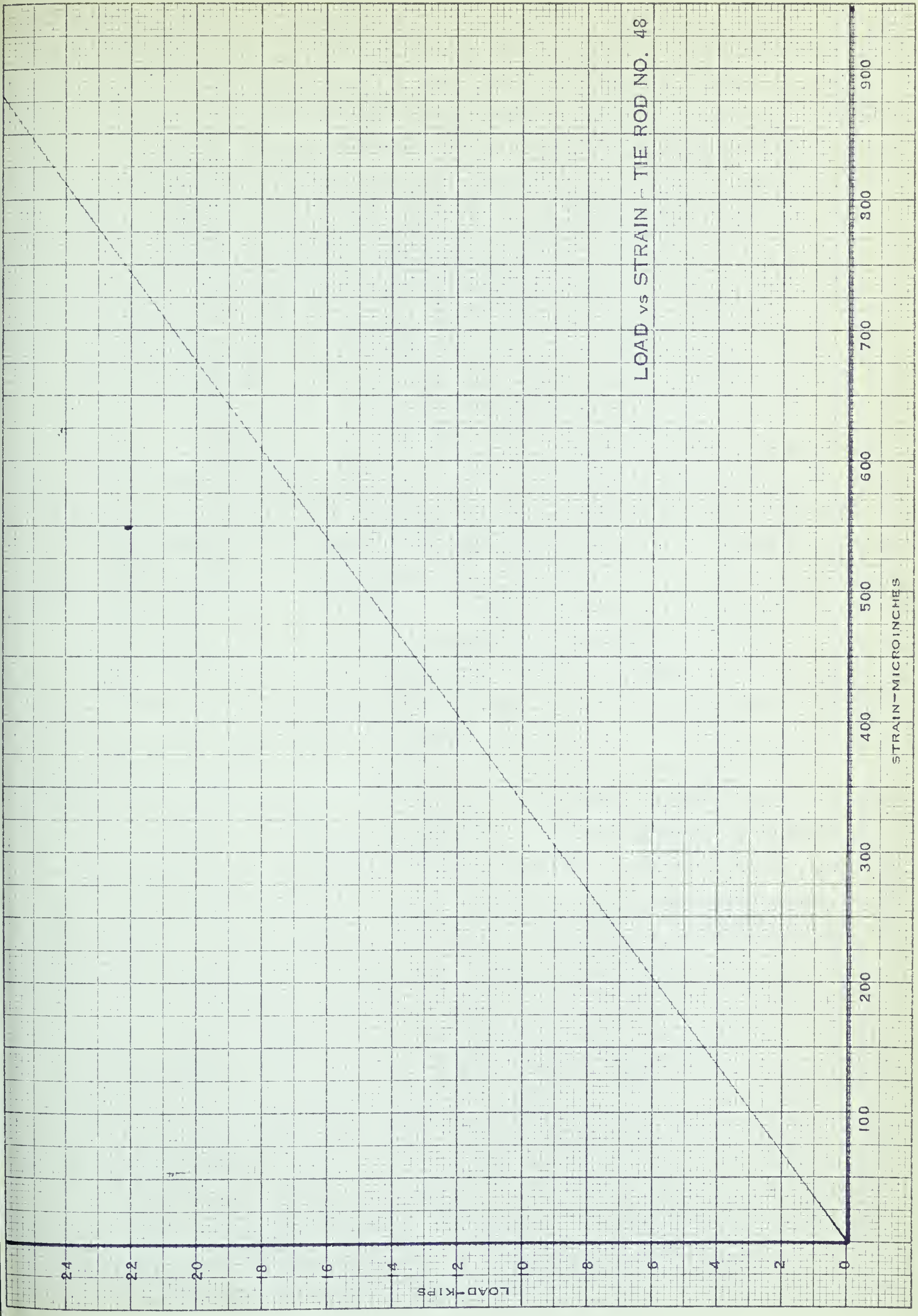
STRAIN-MICROINCHES


LOAD vs STRAIN - TIE ROD NO. 48
STRAIN-MICROINCHES
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LOAD-KIPS
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18
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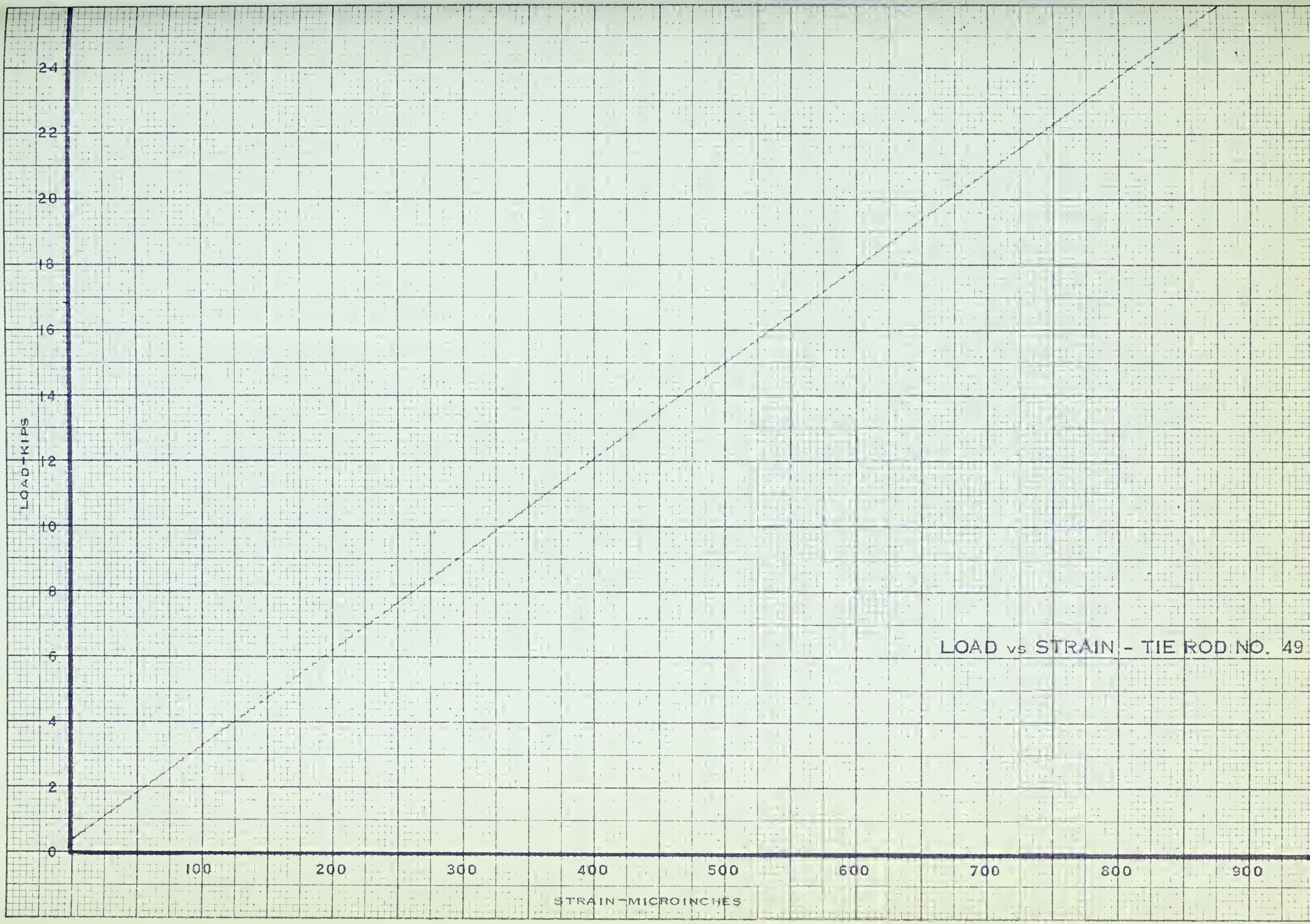
LOAD vs STRAIN - TIE ROD NO. 49
LOAD-KIPS
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22
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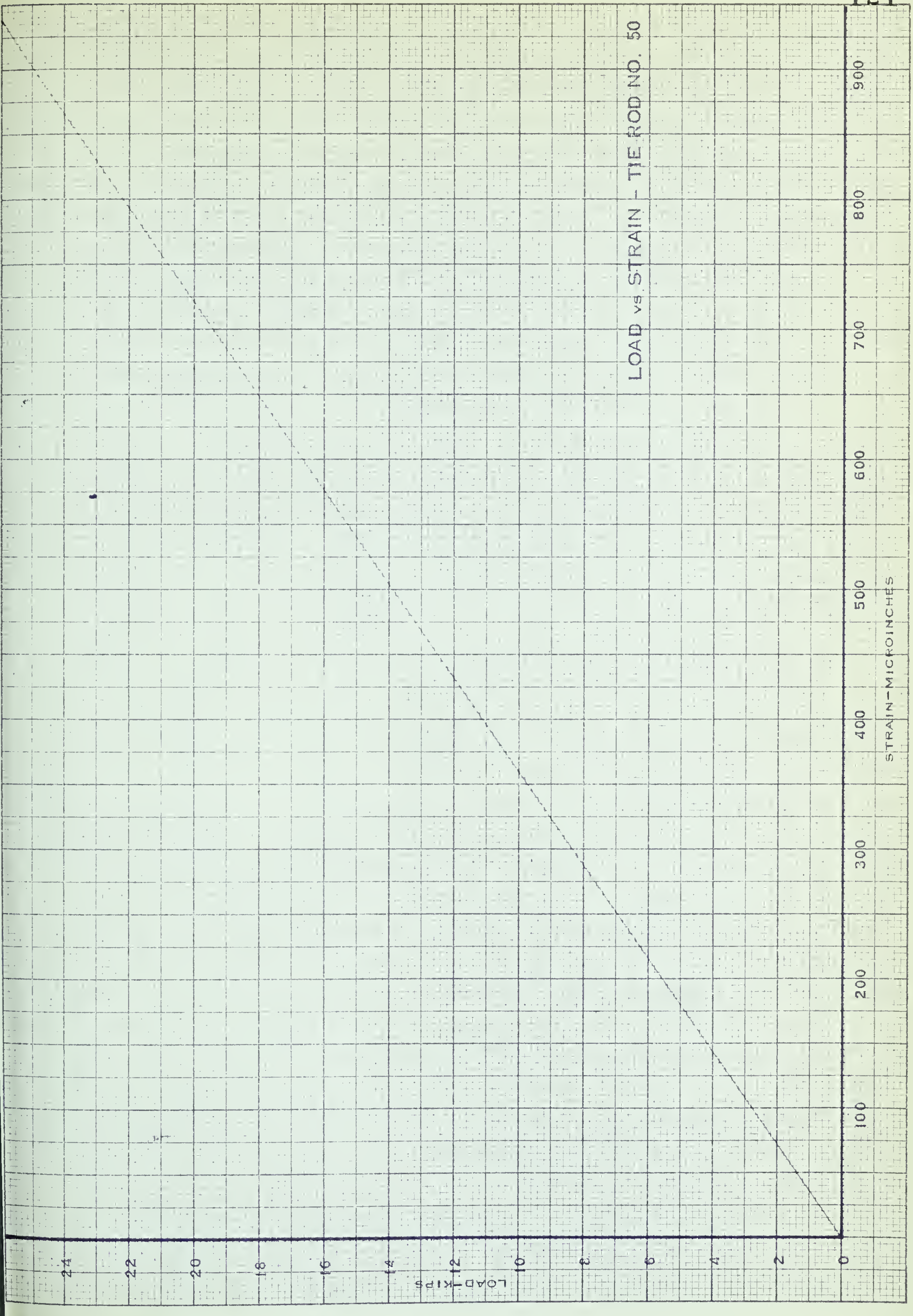
STRAIN-MICROINCHES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LOAD KIPS
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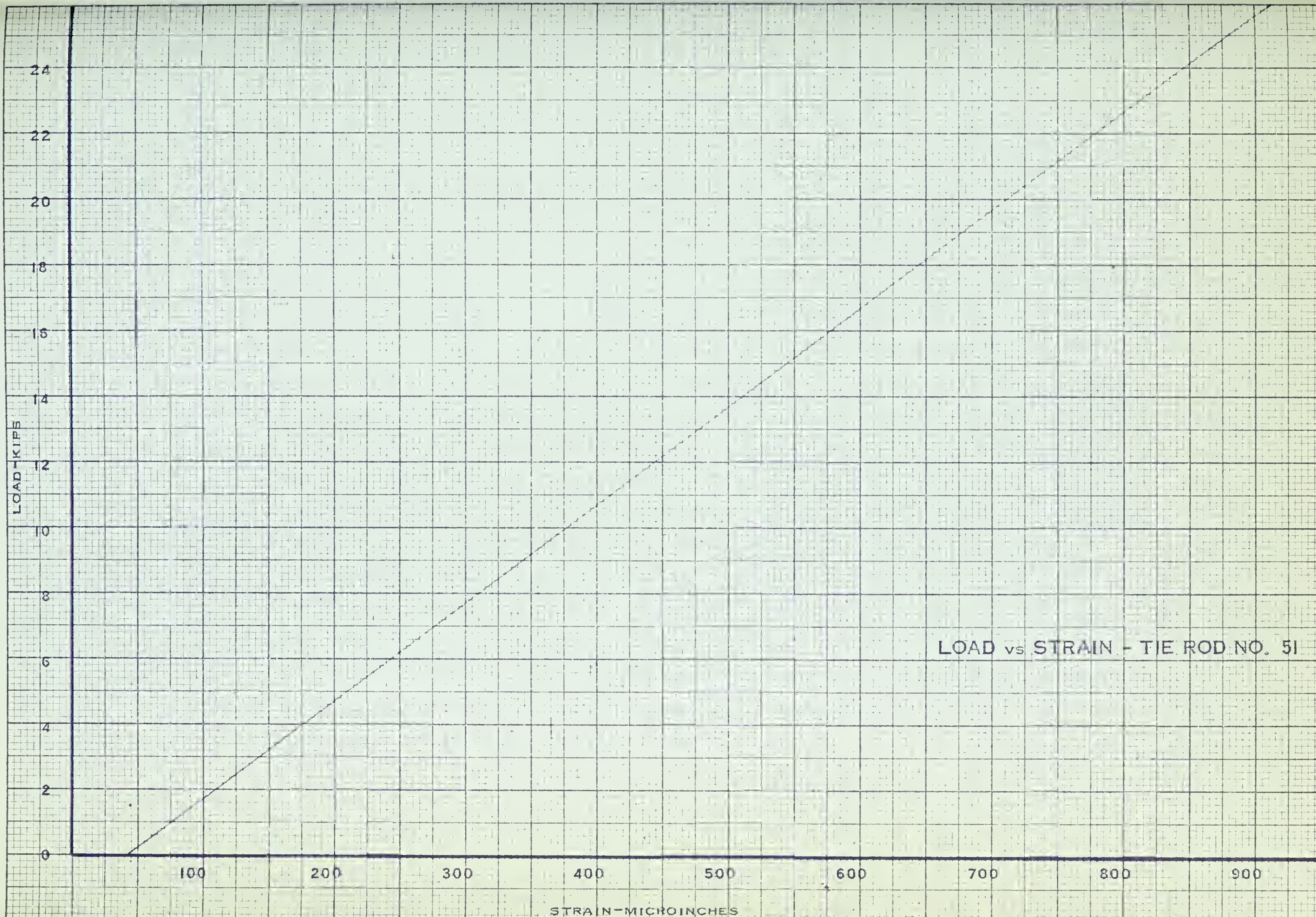
LOAD vs STRAIN - TIE ROD NO. 51
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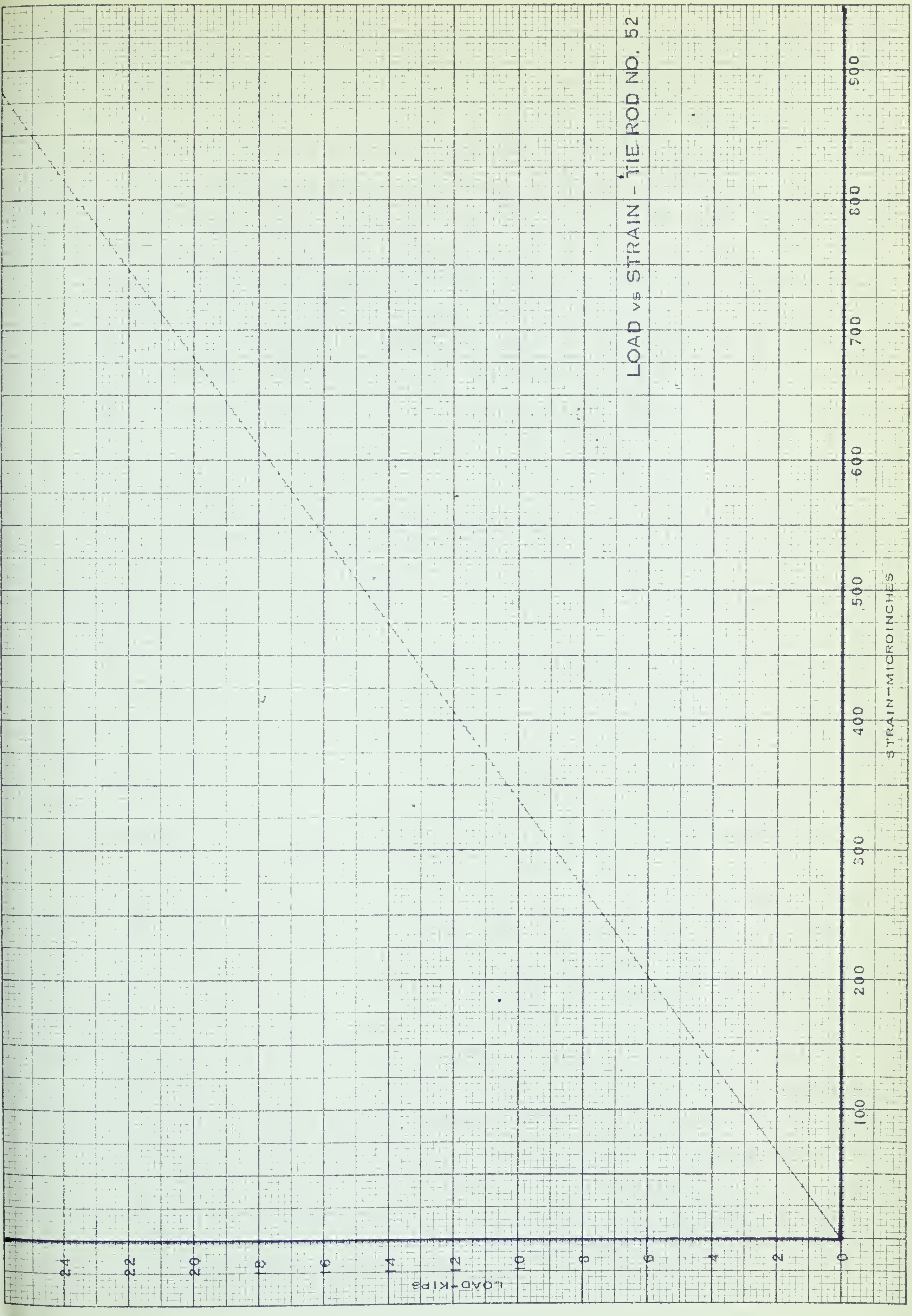
LOAD vs STRAIN - TIE ROD NO. 52
STRAIN-MICROINCHES
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LOAD-KIPS
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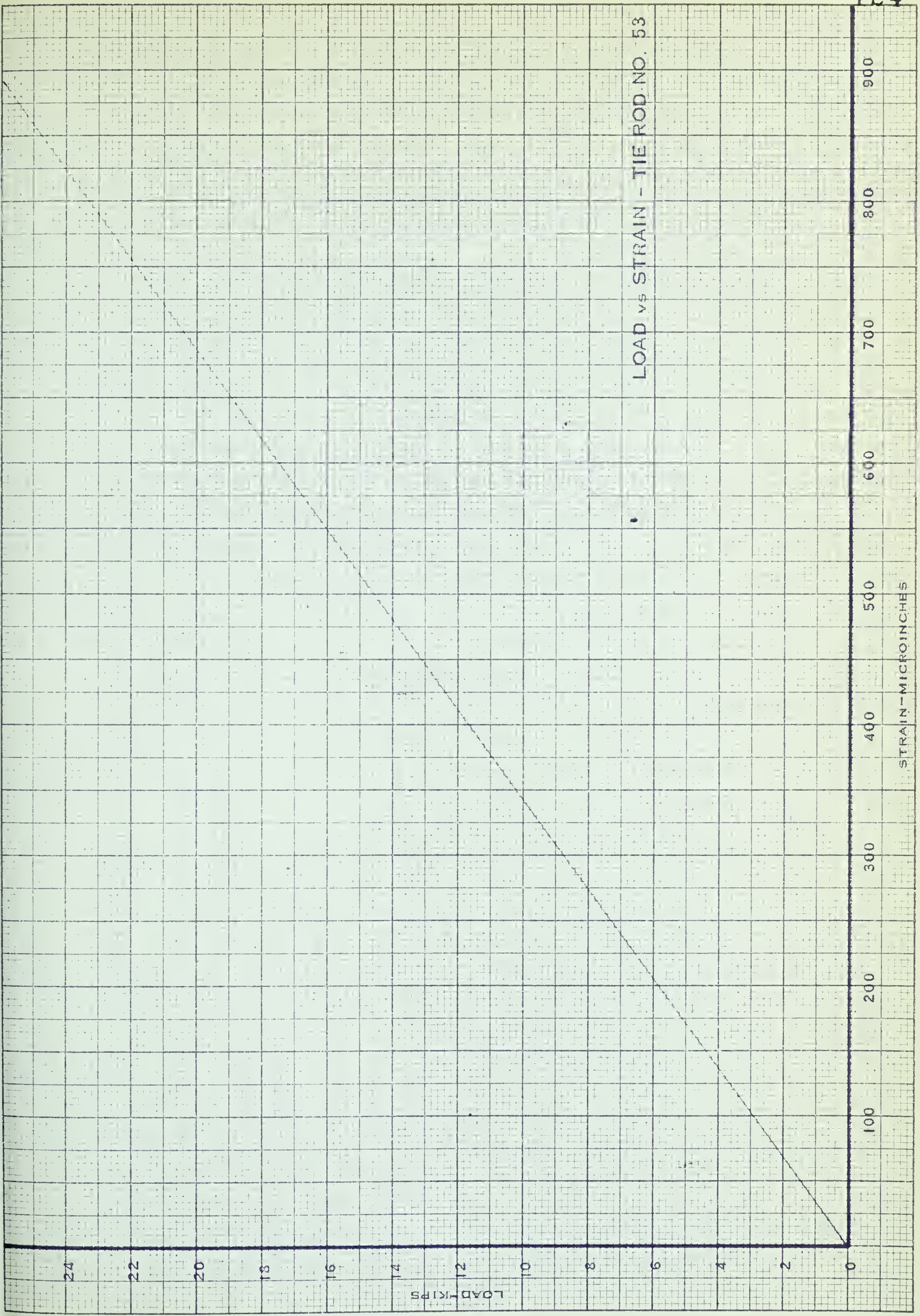

LOAD vs STRAIN - TIE ROD NO. 53
STRAIN-MICROINCHES
LOAD-KIPS
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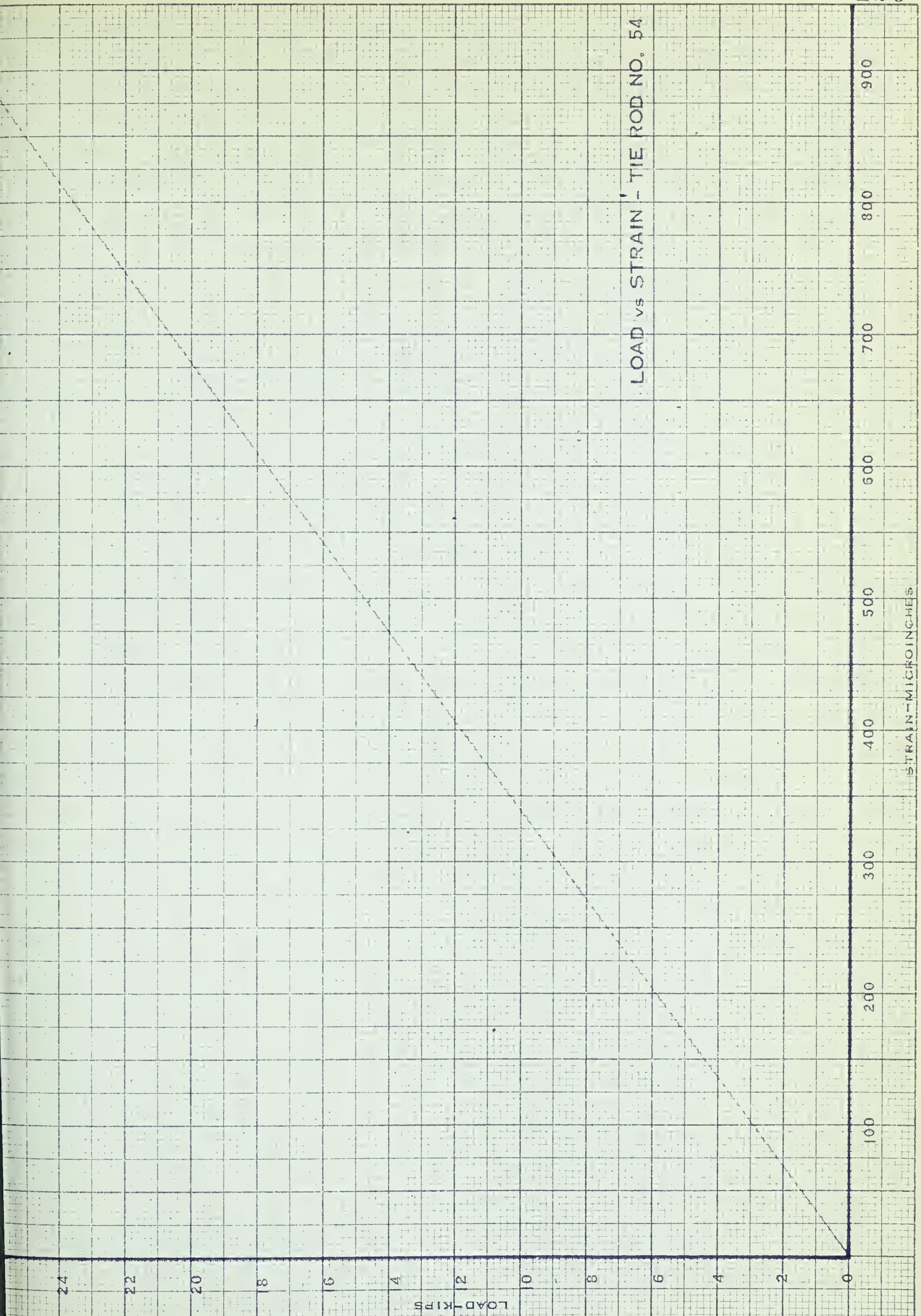
LOAD vs STRAIN - TIE ROD NO. 54
STRAIN-MICROINCHES
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LOAD-KIPS
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APPENDIX II

EXPERIMENTAL DATA

Sample No. 3-R Shrinkage of Concrete Beams Page 1

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
Feb. 26	3	1288		0648		0976		0817		1307		0642			
27	4	73	15	46	2	81	+ 5	14	3	08	+ 1	46	+ 4	1.67	16
28	5	68	20	45	3	80	+ 4	10	4	03	4	45	+ 3	4.00	39
Mar. 1	6	65	23	41	7	78	+ 2	10	4	02	5	44	+ 2	5.83	57
2	7	62	26	41	7	77	+ 1	06	11	04	3	43	+ 1	7.50	74
3	8	60	28	37	11	71	5	01	16	1295	12	38	4	12.67	124
4	9	57	31	36	12	67	9	0798	19	92	15	37	5	15.16	149
5	10	55	33	33	15	67	9	98	19	90	17	36	6	16.50	162
6	11	52	36	32	16	67	9	97	20	97	10	32	10	16.83	165
7	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	13	50	38	30	18	65	11	92	25	92	15	30	12	19.83	194
9	14	50	38	29	19	62	14	84	33	85	22	26	16	23.67	232
10	15	47	41	27	21	61	15	90	27	89	18	29	13	24.16	237
11	16	47	41	27	21	61	15	80	37	84	23	27	15	25.33	248
12	17	46	42	26	22	60	16	80	37	80	27	26	16	26.67	261
13	18	47	41	23	25	59	17	80	37	80	27	25	17	27.33	268
14	19	47	41	23	25	58	18	81	36	80	27	26	16	27.16	266
15	20	46	42	23	25	58	18	80	37	77	30	26	16	28.0	274
16	21	42	46	22	26	58	18	80	37	80	27	22	20	29.0	284
17	22	43	45	22	26	57	19	80	37	80	27	23	19	28.67	281
18	23	42	46	20	28	54	22	80	37	80	27	22	20	30.0	294
19	24	42	46	19	29	53	23	80	37	80	27	22	20	30.83	302
20	25	41	47	20	28	52	24	77	40	78	29	16	26	32.33	317
21	26	39	49	19	29	53	23	78	39	75	32	15	27	33.33	327
22	27	38	50	16	32	51	25	77	40	75	32	17	25	34.00	333
23	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	29	37	51	15	33	50	26	78	39	75	32	13	29	35.00	343
25	30	36	52	15	33	51	25	75	42	73	34	15	27	35.50	348
26	31	33	55	15	33	50	26	81	36	81	26	17	25	33.50	328
27	32	33	55	12	36	48	28	94	23	80	27	11	31	33.33	326
28	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	35	33	55	13	35	48	28	94	23	72	35	10	32	34.67	340
31	36	31	57	12	36	47	29	91	26	76	31	10	32	35.16	345

Sample No. 3-R   Shrinkage of Concrete Beams

Date	Age-- Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
Apr. 1	37	31	57	13	35	47	29	80	37	75	32	06	36	37.67	369
2	38	30	58	10	38	46	30	80	37	74	33	08	34	38.33	376
3	39	30	58	07	41	44	32	78	39	73	34	03	39	40.50	397
4	40	28	60	07	41	43	33	64	53	71	36	03	39	43.67	428
5	41	29	50	06	42	43	33	77	40	75	32	03	39	40.83	400
6	42	26	62	05	43	43	33	77	40	76	31	0599	43	42.00	412
7	43	25	63	05	43	43	33	75	42	76	31	0600	42	42.33	415
8	44	28	60	10	38	46	30	77	40	76	31	0603	39	39.67	389
9	45	29	59	07	41	43	33	77	40	80	27	0607	35	39.16	384
10	46	27	61	06	42	43	33	77	40	81	26	0600	42	40.67	399
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	48	25	63	05	43	41	35	80	37	79	28	07	35	40.16	394
13	49	24	64	04	44	42	34	80	37	79	28	0599	43	41.67	408
14	50	23	65	04	44	42	34	79	38	79	28	0600	42	41.83	410
15	51	23	65	03	45	41	35	78	39	78	29	0599	43	42.67	418
16	52	23	65	02	46	40	36	74	43	75	32	98	44	44.33	434
17	53	20	68	03	45	38	38	85	32	79	28	98	44	42.50	417
18	54	21	67	03	45	38	38	75	42	80	27	98	44	43.83	430
19	55	20	68	01	47	38	38	72	45	75	32	97	45	45.83	449
20	56	21	67	02	46	39	37	81	36	70	37	97	45	44.67	438
21	57	21	67	02	46	39	37	74	43	71	36	92	50	46.50	456
22	58	20	68	02	46	38	38	74	43	71	36	92	50	46.83	459
23	59	21	67	03	45	38	38	70	47	78	29	98	44	45.00	441
24	60	19	69	02	46	36	40	71	46	74	33	97	45	46.50	456
25	61	19	69	01	47	36	40	71	46	74	33	96	46	46.83	459
26	62	17	71	0598	50	35	41	70	47	71	36	98	44	48.17	472
27	63	17	71	98	50	35	41	71	46	71	36	95	47	48.50	475
28	64	17	71	97	51	35	41	71	46	74	33	92	50	48.67	477
29	65	16	72	96	52	35	41	71	46	74	33	92	50	49.00	480
30	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-
May 1	67	14	74	93	55	33	43	69	48	70	37	90	52	51.50	505
2	68	16	72	97	51	32	44	70	47	75	32	96	46	48.67	477
3	69	20	68	99	49	32	44	79	38	76	31	91	51	46.83	459
4	70	16	72	94	54	31	45	80	37	75	32	90	52	48.67	477

Sample No. 3-R   Shrinkage of Concrete Beams   Page 3

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
May 5	71	18	70	96	52	32	44	66	51	70	37	0587	55	51.50	505
6	72	19	69	96	52	33	43	65	52	67	40	87	55	51.83	508
7	73	18	70	97	51	33	43	64	53	66	41	78	64	53.67	526
8	74	15	73	96	52	40	36	70	47	66	41	90	52	50.17	492
9	75	17	71	94	54	40	36	68	49	66	41	90	52	50.50	495
10	76	16	72	94	54	32	44	76	41	66	41	90	52	50.67	496
11	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	79	16	72	96	52	41	35	76	41	65	42	87	55	49.50	485
14	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	82	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	84	17	71	96	52	62	14	77	40	66	41	82	60	46.33	454
19	85	17	71	97	51	65	11	77	40	65	42	83	59	45.67	448
20	86	18	70	96	52	64	12	76	41	65	42	82	60	46.17	452
21	87	18	70	96	52	64	12	75	42	72	35	84	58	44.83	439
22	88	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	89	13	75	92	56	60	16	76	41	75	32	84	58	46.33	454
24	90	16	72	95	53	62	14	76	41	79	28	84	58	44.33	434
25	91	15	73	93	55	63	13	81	36	72	35	84	58	45.00	441
26	92	16	72	92	56	62	14	79	38	72	35	82	60	45.83	449
27	93	15	73	93	55	61	15	75	42	70	37	84	58	46.67	457
28	94	15	73	92	56	61	15	74	43	70	37	82	60	47.33	464
29	95	14	74	92	56	61	15	79	38	76	31	81	61	45.83	449
30	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	97	-	-	-	-	-	-	-	-	-	-	-	-	-	-
June 1	97	15	73	92	56	61	15	81	36	74	33	78	64	46.17	452
2	99	17	71	92	56	62	14	81	36	77	30	80	62	44.83	439
3	100	17	71	93	55	61	15	78	39	78	29	80	62	45.17	443
4	101	17	71	92	56	62	14	80	37	80	27	84	58	43.83	430
5	102	17	71	92	56	60	16	80	37	75	32	83	59	45.17	443
6	103	16	72	92	56	62	14	80	37	79	28	84	58	44.17	432
7	104	15	73	91	57	61	15	79	38	78	29	82	60	45.33	444

Sample No. 3-R　　　Shrinkage of Concrete Beams　　　Page 4

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
June 8	105	15	73	91	57	60	16	78	39	83	24	81	61	45.00	441
9	106	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	107	16	72	90	58	60	16	77	40	86	21	81	61	44.67	438
11	108	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	109	22	66	95	53	65	11	77	40	87	20	81	61	41.83	410
13	110	16	72	93	55	64	12	77	40	87	20	82	60	43.17	423
14	111	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	112	16	72	93	55	64	12	77	40	83	24	80	62	44.17	433
16	113	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	114	16	72	92	56	61	15	71	34	78	29	84	58	44.00	431
18	115	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	116	20	68	95	53	65	11	77	40	81	26	88	54	42.00	412
20	117	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	118	18	70	94	54	64	12	75	42	84	23	82	60	43.50	426
22	119	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	121	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	122	19	69	93	55	64	12	77	40	80	27	82	60	43.83	430
26	123	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	124	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	126	19	69	93	55	63	13	79	38	81	26	87	55	42.67	418
30	127	22	66	93	55	65	11	76	41	82	25	87	55	42.17	413
July 1	128	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	129	21	67	94	54	64	12	74	43	80	27	87	55	43.00	421
3	130	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	131	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	132	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	133	21	67	93	55	64	12	73	44	80	27	87	55	43.33	425
7	134	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	135	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	136	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	137	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sample No. 3-R

Shrinkage of Concrete Beams

Page 5

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in. x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
July 11	138	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	139	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	140	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	141	20	68	93	55	64	12	73	44	80	27	87	55	43.50	426
15	142	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	143	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	144	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	145	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	146	19	69	93	55	65	11	72	45	79	28	86	56	44.00	431
20	147	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	148	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	149	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	151	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	152	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	153	18	70	93	55	65	11	72	45	77	30	85	57	44.67	438
27	154	18	70	92	56	65	11	72	45	78	29	85	57	44.67	438

Sample No. 4-R   Shrinkage of Concrete Beams   Page 1

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
Feb. 26	3	1155		0907		1005		0921		0850		0862			
27	4	57	+ 2	25	+ 18	07	+ 2	21	0	51	+ 1	62	0	+3.83	+ 39
28	5	52	3	10	3	03	2	17	4	50	0	63	1	0.83	8
Mar. 1	6	51	4	07	0	01	4	17	4	47	3	58	4	3.33	33
2	7	51	4	05	2	1000	5	16	5	47	3	59	3	3.67	36
3	8	45	10	01	6	0996	9	14	7	44	6	59	3	6.83	67
4	9	40	15	0900	7	93	12	12	9	41	9	52	10	10.33	101
5	10	39	16	0897	10	91	14	09	12	40	10	48	14	12.67	124
6	11	41	14	97	10	90	15	10	11	40	10	52	10	11.67	114
7	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	13	35	20	95	12	87	18	06	15	38	12	50	12	14.83	145
9	14	34	21	94	13	84	21	01	20	35	15	44	18	18.00	176
10	15	34	21	90	17	84	21	04	17	36	14	48	14	17.33	170
11	16	34	21	94	13	84	21	02	19	34	16	45	17	17.83	175
12	17	33	22	90	17	83	22	0900	21	33	17	42	20	19.67	193
13	18	33	22	90	17	82	23	0900	21	33	17	42	20	20.00	196
14	19	32	23	90	17	81	24	0900	21	31	19	43	19	25.00	201
15	20	32	23	90	17	81	24	0900	21	31	19	39	23	21.16	207
16	21	28	27	87	20	79	26	96	25	31	19	39	23	23.33	228
17	22	30	25	88	19	78	27	97	24	31	19	39	23	22.83	224
18	23	30	25	88	19	78	27	97	24	30	20	38	24	23.16	227
19	24	32	23	86	21	78	27	96	25	30	20	39	23	23.33	228
20	25	27	28	85	22	76	29	96	25	30	20	36	26	25.00	245
21	26	27	28	84	23	75	30	94	27	29	21	35	27	26.00	255
22	27	27	28	84	23	75	30	93	28	25	25	35	27	26.83	263
23	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	29	22	33	82	25	72	33	92	29	26	24	32	30	29.00	284
25	30	24	31	82	25	72	33	91	30	26	24	34	28	28.50	279
26	31	24	31	83	24	70	35	89	32	24	26	33	29	29.50	289
27	32	22	33	81	26	69	36	89	32	23	27	31	31	30.83	302
28	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	35	22	33	80	27	69	36	88	33	23	26	32	30	31.00	304
31	36	21	34	80	27	68	37	88	33	22	28	30	32	31.83	312

Sample No. 4-R Shrinkage of Concrete Beams Page 2

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
Apr. 1	37	20	35	78	29	68	37	87	34	24	26	29	33	32.33	317
2	38	20	35	77	30	67	38	87	34	22	28	31	31	32.67	320
3	39	18	37	80	27	65	40	86	35	19	31	30	32	33.67	330
4	40	18	37	76	31	65	40	83	38	19	31	27	35	35.33	346
5	41	18	37	75	32	64	41	84	37	18	32	27	35	35.67	350
6	42	15	40	75	32	63	42	82	39	18	32	26	36	36.83	361
7	43	15	40	75	32	63	42	81	40	18	32	27	35	36.83	361
8	44	19	36	77	30	66	39	83	38	21	29	29	33	34.16	335
9	45	19	36	74	33	65	40	83	38	20	30	28	34	35.16	345
10	46	15	40	76	31	63	42	83	38	20	30	28	34	35.83	351
11	47	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	48	15	40	74	33	62	43	81	40	17	33	26	36	37.50	368
13	49	14	41	73	34	61	44	81	40	17	33	26	36	38.00	372
14	50	14	41	71	36	60	45	81	40	18	32	25	37	38.50	377
15	51	14	41	71	36	60	45	81	40	18	32	26	36	38.33	376
16	52	15	40	70	37	60	45	79	42	16	34	23	39	39.50	387
17	53	13	42	71	36	60	45	79	42	16	34	24	38	39.50	387
18	54	11	44	71	36	60	45	79	42	15	35	27	35	39.50	387
19	55	12	43	70	37	59	46	78	43	16	34	26	36	39.83	390
20	56	13	42	70	37	59	46	78	43	14	36	24	38	40.33	395
21	57	11	44	70	37	58	47	77	44	17	33	24	38	40.50	397
22	58	10	45	69	38	58	47	77	44	16	34	24	38	41.00	402
23	59	13	42	70	37	60	45	78	43	15	35	22	40	43.33	395
24	60	12	43	70	37	59	46	77	44	13	37	24	38	40.83	400
25	61	10	45	68	39	57	48	78	43	13	37	24	38	41.67	408
26	62	11	44	69	38	57	48	76	45	11	39	23	39	42.17	413
27	63	09	46	68	39	58	47	76	45	12	38	23	39	42.50	417
28	64	07	48	68	39	57	48	77	44	12	38	23	39	42.67	418
29	65	07	48	70	37	59	46	77	44	14	36	23	39	43.33	425
30	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-
May 1	67	06	49	72	35	58	47	75	46	12	38	22	40	42.50	417
2	68	07	48	67	40	54	51	74	47	11	39	21	41	44.33	434
3	69	15	40	68	39	55	50	78	43	10	40	27	35	41.17	403
4	70	10	45	69	38	55	50	76	45	10	40	26	36	42.33	415

Sample No. 4-R Shrinkage of Concrete Beams Page 3

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
May 5	71	08	47	66	41	53	52	74	47	07	43	22	40	45.00	441
6	72	05	50	67	40	54	51	73	48	07	43	20	42	45.67	448
7	73	05	50	68	39	54	51	73	48	08	42	20	42	45.33	444
8	74	05	50	67	40	55	50	76	45	09	41	24	38	44.00	431
9	75	11	44	66	41	54	51	74	47	07	43	26	36	43.67	428
10	76	14	41	65	42	54	51	76	45	07	43	25	37	43.17	423
11	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	79	15	40	66	41	54	51	76	45	07	43	25	37	42.83	420
14	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	82	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	84	14	41	65	42	54	51	76	45	07	43	24	38	43.33	425
19	85	14	41	66	41	55	50	75	46	09	41	25	37	42.67	418
20	86	14	41	65	42	56	49	75	46	09	41	26	36	42.67	418
21	87	14	41	64	43	54	51	75	46	08	42	25	37	43.17	423
22	88	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	89	12	43	63	44	51	54	75	46	08	42	24	38	44.50	436
24	90	10	45	63	44	51	54	76	45	07	43	22	40	45.17	443
25	91	11	44	63	44	50	55	79	42	05	45	21	41	45.17	443
26	92	10	45	62	45	50	55	78	43	05	45	22	40	45.50	446
27	93	12	43	64	43	53	52	76	45	06	44	24	38	44.17	433
28	94	11	44	64	43	51	54	78	43	05	45	23	39	44.67	438
29	95	11	44	62	45	53	52	76	45	05	45	21	41	45.33	444
30	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	97	-	-	-	-	-	-	-	-	-	-	-	-	-	-
June 1	98	11	44	64	43	53	52	77	44	05	45	22	40	44.67	438
2	99	11	44	64	43	51	54	77	44	07	43	24	38	44.33	434
3	100	11	44	64	43	53	52	77	44	06	44	24	38	44.17	433
4	101	11	44	63	44	52	53	72	49	05	24	38		45.50	446
5	102	12	43	62	45	51	54	75	46	05	45	22	40	45.50	446

Sample No. 4-R

Shrinkage of Concrete Beams

Page 4

Date	Age--Days	Set # 1		Set # 2		Set # 3		Set # 4		Set # 5		Set # 6		Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
		Reading	Accum. Diff.	Reading	Accum. Diff.	Reading	Accum. Diff.	Reading	Accum. Diff.	Reading	Accum. Diff.	Reading	Accum. Diff.		
May 6	72	05	50	67	40	54	51	73	48	07	43	20	42	45.67	448
7	73	05	50	68	39	54	51	73	48	08	42	20	42	45.33	444
8	74	05	50	67	40	55	50	76	45	09	41	24	38	44.00	431
9	75	11	44	66	41	54	51	74	47	07	43	26	36	43.67	428
10	76	14	41	65	42	54	51	76	45	07	43	25	37	43.17	423
11	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	79	15	40	66	41	54	51	76	45	07	43	25	37	42.83	420
14	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	82	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	84	14	41	65	42	54	51	76	45	07	43	24	38	43.33	425
19	85	14	41	66	41	55	50	75	46	09	41	25	37	42.67	418
20	86	14	41	65	42	56	49	75	46	09	41	26	36	42.67	418
21	87	14	41	64	43	54	51	75	46	08	42	25	37	43.17	423
22	88	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	89	12	43	63	44	51	54	75	46	08	42	24	38	44.50	436
24	90	10	45	63	44	51	54	76	45	07	43	22	40	45.17	443
25	91	11	44	63	44	50	55	79	42	05	45	21	41	45.17	443
26	92	10	45	62	45	50	55	78	43	05	45	22	40	45.50	446
27	93	12	43	64	43	53	52	76	45	06	44	24	38	44.17	433
28	94	11	44	64	43	51	54	78	43	05	45	23	39	44.67	438
29	95	11	44	62	45	53	52	76	45	05	45	21	41	45.33	444
30	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	97	-	-	-	-	-	-	-	-	-	-	-	-	-	-
June 1	98	11	44	64	43	53	52	77	44	05	45	22	40	44.67	438
2	99	11	44	64	43	51	54	77	44	07	43	24	38	44.33	434
3	100	11	44	64	43	53	52	77	44	06	44	24	38	44.17	433
4	101	11	44	63	44	52	53	72	49	05	45	24	38	45.50	446
5	102	12	43	62	45	51	54	75	46	05	45	22	40	45.50	446
6	103	10	45	62	45	47	58	74	47	04	46	24	38	46.50	456
7	104	11	44	64	43	50	55	73	48	03	47	22	40	46.17	452

Sample No. 4-R   Shrinkage of Concrete Beams   Page 5

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
June 8	105	08	47	62	45	50	55	74	47	01	49	22	40	47.17	462
9	106	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	107	08	47	62	45	50	55	74	47	05	45	26	36	45.83	449
11	108	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	109	16	39	65	42	54	51	78	43	05	45	28	34	42.33	415
13	110	15	40	63	44	53	52	78	43	04	46	26	36	43.50	426
14	111	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	112	14	41	63	44	52	53	78	43	03	47	25	37	44.17	433
16	113	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	114	16	39	62	45	53	52	77	44	03	47	26	36	43.83	430
18	115	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	116	17	38	64	43	56	49	78	43	04	46	25	37	42.83	420
20	117	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	118	16	39	64	43	54	51	76	45	05	45	24	38	43.50	426
22	119	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	121	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	122	14	41	62	45	52	53	77	44	04	46	28	34	43.83	430
26	123	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	124	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	126	14	41	62	45	52	53	77	44	04	45	26	32	43.33	425
30	127	16	39	63	44	55	50	78	43	06	44	26	32	42.00	412
July 1	128	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	129	15	40	62	45	54	51	76	45	05	45	26	32	43.50	421
3	130	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	131	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	132	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	133	14	41	61	46	54	51	75	46	04	46	27	31	44.00	426
7	134	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	135	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	136	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	137	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	138	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sample No. 4-R   Shrinkage of Concrete Beams   Page 6

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
July 12	139	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	140	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	141	14	41	59	48	54	51	75	46	04	46	26	32	43.83	431
15	142	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	143	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	144	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	145	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	146	14	41	61	46	53	52	76	45	04	46	25	33	44.33	430
20	147	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	148	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	149	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	151	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	152	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	153	14	41	61	46	52	53	75	46	04	46	24	34	44.33	434
27	154	14	41	61	46	52	53	76	45	04	46	23	35	44.33	434

Sample No. 5-R　　　　Shrinkage of Concrete Beams　　　　Page 1

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
Feb. 26	3	0952	-	1268	-	0415	-	0988	-	0901	-	0742	-	-	-
27	4	53	+ 1	63	5	17	+ 2	86	2	0898	3	46	+ 4	0.50	5
28	5	46	6	62	6	10	5	82	6	97	4	41	1	4.67	46
March 1	6	43	9	57	11	10	5	81	7	93	8	38	4	7.33	72
2	7	46	6	60	8	10	5	80	8	92	9	36	6	7.00	69
3	8	39	13	54	14	06	9	77	11	90	11	34	8	11.00	107
4	9	36	16	50	18	04	11	74	14	85	16	29	13	14.67	144
5	10	35	17	47	21	03	12	69	19	84	17	28	14	16.67	163
6	11	35	17	50	18	03	12	70	18	82	19	28	14	16.33	160
7	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	13	33	19	50	18	02	13	66	22	82	19	25	17	18.00	176
9	14	29	23	48	20	0399	16	61	27	79	22	22	20	21.33	209
10	15	28	24	45	23	98	17	67	21	80	21	22	20	21.00	206
11	16	29	23	45	23	98	17	65	23	79	22	22	20	21.33	209
12	17	29	23	44	24	97	18	63	25	79	22	19	23	22.50	221
13	18	29	23	41	27	97	18	63	25	79	22	19	23	23.00	225
14	19	28	24	36	32	96	19	62	26	78	23	21	21	24.16	237
15	20	28	24	36	32	96	19	60	28	77	24	20	22	24.83	243
16	21	26	26	34	34	95	20	60	28	75	26	15	27	26.83	263
17	22	27	25	34	34	95	20	59	29	75	26	17	25	26.50	260
18	23	26	26	34	34	95	20	60	28	73	28	17	25	27.00	265
19	24	25	27	33	35	95	20	58	30	73	28	16	26	27.67	271
20	25	24	28	31	37	90	25	58	30	71	30	14	28	29.67	291
21	26	23	29	30	38	90	25	57	31	70	31	13	29	30.50	299
22	27	21	31	30	38	90	25	56	32	71	30	13	29	30.83	302
23	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	29	23	29	30	38	90	25	56	32	70	31	14	28	30.50	299
25	30	21	31	34	34	90	25	55	33	69	32	12	30	30.83	302
26	31	19	33	29	39	88	27	53	35	67	34	11	31	33.16	325
27	32	18	34	25	43	87	28	52	36	67	34	09	33	34.67	340
28	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	35	19	33	30	38	87	28	52	36	65	36	10	32	33.83	322
31	36	19	33	28	40	88	27	52	36	66	35	07	35	34.33	3364

Sample No. 5-R   Shrinkage of Concrete Beams   Page 2

Date	Age-- Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
Apr. 1	37	17	35	26	42	86	29	50	38	66	35	07	35	35.67	350
2	38	18	34	28	40	86	29	50	38	65	36	07	35	35.33	346
3	39	14	38	22	46	82	33	46	42	64	37	03	39	39.33	385
4	40	15	37	25	43	85	30	47	41	64	37	05	37	37.50	368
5	41	15	37	25	43	84	31	474	41	63	38	04	38	38.00	372
6	42	12	40	22	46	82	33	46	42	62	39	02	40	40.00	392
7	43	12	40	21	47	82	33	47	41	62	39	03	39	39.83	390
8	44	14	38	22	46	84	31	48	40	64	37	06	36	38.00	372
9	45	16	36	23	45	84	31	48	40	64	37	06	36	37.50	368
10	46	16	36	22	46	82	33	47	41	63	38	04	38	38.67	379
11	47	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	48	14	38	21	47	81	34	46	42	61	40	02	40	40.17	394
13	49	13	39	20	48	80	35	44	44	60	41	01	41	41.33	405
14	50	12	40	18	50	78	37	45	43	61	40	0700	42	42.00	412
15	51	12	40	19	49	80	35	45	43	61	40	02	40	41.16	403
16	52	12	40	20	48	80	35	45	43	61	40	03	39	40.83	400
17	53	11	41	17	51	80	35	44	44	59	42	02	40	42.50	417
18	54	11	41	17	51	79	36	44	44	59	42	01	41	42.83	420
19	55	10	42	18	50	78	37	44	44	59	42	01	41	43.00	421
20	56	11	41	19	49	79	36	43	45	58	43	0701	41	42.83	420
21	57	10	42	20	48	79	36	42	46	58	43	0698	44	43.16	423
22	58	10	42	19	49	78	37	44	44	59	42	0702	40	42.33	415
23	59	11	41	17	51	78	37	42	46	58	43	02	40	43.00	421
24	60	11	41	17	51	79	36	43	45	58	43	02	40	42.67	418
25	61	10	42	17	51	78	37	44	44	58	43	02	40	42.83	420
26	62	10	42	16	52	77	38	42	46	56	45	0699	43	44.33	434
27	63	10	42	16	52	76	39	44	44	55	46	98	44	44.50	436
28	64	10	42	16	52	76	39	44	44	55	46	98	44	44.50	436
29	65	10	42	15	53	76	39	45	43	56	45	96	46	44.67	438
30	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sample No. 5-R   Shrinkage of Concrete Beams   Page 3

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
May 1	67	09	43	15	53	75	40	44	44	55	46	96	46	45.33	444
2	68	05	47	11	57	75	40	42	46	54	47	0698	44	46.83	459
3	69	16	36	09	59	73	42	50	38	55	46	0700	42	43.83	429
4	70	17	35	10	58	72	43	49	39	53	48	0695	47	45.00	441
5	71	14	38	09	59	72	43	43	45	53	48	96	46	46.50	456
6	72	13	39	08	60	70	45	43	45	53	48	95	47	47.33	464
7	73	13	39	09	59	70	45	44	44	54	47	95	47	46.83	459
8	74	16	36	10	58	72	43	45	43	55	46	98	44	45.00	441
9	75	13	39	07	61	69	46	42	46	52	49	98	44	47.50	466
10	76	16	36	09	59	71	44	41	47	53	48	97	45	46.50	456
11	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	79	16	36	10	58	72	43	42	46	53	48	97	45	46.00	451
14	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	82	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	84	17	35	09	59	71	44	42	46	52	49	97	45	46.33	454
19	85	17	35	09	59	72	43	44	44	51	50	97	45	46.00	451
20	86	16	36	08	60	71	44	44	44	52	49	97	45	46.33	454
21	87	17	35	08	60	70	45	46	42	51	50	97	45	46.17	452
22	88	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	89	16	36	07	61	68	47	45	43	52	49	97	45	46.83	459
24	90	14	38	07	61	68	47	45	43	50	51	95	47	47.83	469
25	91	15	37	06	62	69	46	43	45	50	51	96	46	47.83	469
26	92	15	37	07	61	68	47	46	42	50	51	95	47	47.50	466
27	93	15	37	07	61	69	46	46	42	50	51	96	46	47.17	462
28	94	14	38	07	61	69	46	45	43	49	52	96	46	47.67	467
29	95	13	39	07	61	70	45	44	44	50	51	95	47	47.83	468
30	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	97	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sample No. 5-R Shrinkage of Concrete Beams Page 4

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
June 1	98	13	39	06	62	69	46	45	43	50	51	94	48	48.17	472
2	99	12	40	07	61	69	46	45	43	53	48	96	46	47.33	464
3	100	14	38	06	62	68	47	44	44	50	51	98	44	47.67	467
4	101	14	38	08	60	68	47	45	43	52	49	95	47	47.33	464
5	102	14	38	06	62	69	46	43	45	52	49	98	44	47.33	464
6	103	15	37	05	63	70	45	44	44	51	50	94	48	47.83	469
7	104	14	38	06	62	68	47	47	41	50	51	92	50	48.17	472
8	105	15	37	05	63	67	48	45	43	50	51	93	49	48.50	475
9	106	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	107	16	36	06	62	66	49	47	41	50	51	96	46	47.50	466
11	108	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	109	16	36	08	60	68	47	46	42	53	48	98	44	46.16	452
13	110	16	36	06	62	68	48	51	37	53	48	96	46	46.17	452
14	111	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	112	12	40	05	63	65	50	50	38	52	49	96	46	47.67	467
16	113	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	114	12	40	06	62	68	47	50	38	53	48	98	44	46.50	456
18	115	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	116	16	36	07	61	67	48	50	38	58	43	00	42	44.67	438
20	117	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	118	16	36	07	61	68	47	50	38	53	48	98	44	45.67	448
22	119	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	121	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	122	15	37	07	61	68	47	52	36	53	48	96	46	45.83	449
26	123	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	124	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	126	15	37	08	60	68	47	50	38	52	49	99	43	45.67	448
30	127	16	36	08	60	67	48	50	38	56	45	00	42	44.83	439

Sample No. 5-R   Shrinkage of Concrete Beams   Page 5

Date	Age-- Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in. x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
July 1	128	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	129	16	36	10	58	70	45	50	38	54	47	98	44	44.67	438
3	130	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	131	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	132	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	133	15	37	10	58	69	46	50	38	56	45	97	45	44.83	439
7	134	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	135	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	136	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	137	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	138	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	139	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	140	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	141	15	37	10	58	69	46	50	38	55	46	97	45	45.00	441
15	142	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	143	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	144	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	145	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	146	15	37	09	59	71	44	50	38	55	46	97	45	44.83	439
20	147	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	148	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	149	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	151	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	152	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	153	15	37	09	59	70	45	50	38	55	46	97	45	45.00	441
27	154	15	37	09	59	71	44	50	38	55	46	97	45	44.83	439

Sample No. 3-L Shrinkage of Concrete Beams Page 1

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
May 2	3	0838	-	1321	-	0615	-	0967	-	0793	-	0923	-	-	-
3	4	42	+ 4	24	+ 3	19	+ 4	69	+ 2	96	+ 3	28	+ 5	+ 3.50	+ 34
4	5	40	+ 2	21	0	16	+ 1	68	+ 1	90	3	25	+ 2	+ 0.50	+ 5
5	6	36	2	19	2	12	3	64	3	88	5	20	3	3.00	29
6	7	36	2	19	2	13	2	65	2	87	6	19	4	3.00	29
7	8	36	2	18	3	14	1	64	3	86	7	18	5	3.50	34
8	9	34	4	17	4	11	4	57	10	95	8	18	5	5.83	57
9	10	32	6	13	8	08	7	57	10	85	8	13	10	8.17	80
10	11	25	13	14	7	06	9	55	12	80	13	14	9	10.50	103
11	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	13	-	-	13	8	04	11	54	13	81	12	15	8	10.83	106
13	14	25	13	-	-	-	-	-	-	-	-	-	-	-	-
14	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	16	20	18	03	18	0600	15	47	20	75	18	04	19	18.00	176
16	17	18	20	01	20	98	17	46	21	71	22	03	20	20.00	196
17	18	18	20	01	20	97	18	46	21	69	24	02	21	20.67	203
18	19	18	20	01	20	97	18	47	20	69	24	0900	23	20.83	204
19	20	18	20	02	19	99	16	49	18	70	23	02	21	19.50	191
20	21	20	18	02	19	99	16	49	18	70	23	01	22	19.33	189
21	22	18	20	1300	21	98	17	47	20	72	21	01	22	20.17	198
22	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	24	15	23	1298	23	96	19	43	24	70	23	0900	23	22.50	221
24	25	13	25	95	26	94	21	43	24	69	24	0899	24	24.00	235
25	26	12	26	93	28	93	22	42	25	60	33	94	29	27.17	266
26	27	10	28	92	29	92	23	41	26	66	27	95	28	26.83	263
27	28	11	29	92	29	92	23	42	25	63	30	95	28	27.33	268
28	29	10	28	91	30	92	23	41	26	60	33	94	29	28.17	276
29	30	10	28	91	30	90	25	39	28	55	38	92	31	30.00	294
30	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sample No. 3L　　　Shrinkage of Concrete Beams　　　Page 2

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
June 1	33	08	30	89	32	88	27	38	29	59	34	90	33	30.83	302
2	34	06	32	86	35	87	28	36	31	58	35	89	34	32.50	318
3	35	05	33	86	35	88	27	37	30	59	34	88	35	32.33	317
4	36	04	34	86	35	86	29	35	32	56	37	88	35	33.67	330
5	37	04	34	85	36	86	29	35	32	57	36	87	36	34.00	333
6	38	04	34	83	38	84	31	35	32	57	36	86	37	34.67	340
7	39	01	37	83	38	83	32	33	34	57	36	84	39	36.00	353
8	40	0800	38	82	39	81	34	31	36	53	40	83	40	37.83	371
9	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	42	0799	39	82	39	81	34	35	32	54	39	89	34	36.17	354
11	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	44	03	35	86	35	84	31	36	31	60	33	88	35	32.33	316
13	45	03	35	84	37	84	31	34	33	58	35	85	38	34.83	341
14	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	47	0797	41	81	40	81	34	34	33	59	34	85	38	36.67	359
16	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	49	99	39	80	41	81	34	33	34	54	39	83	40	37.83	371
18	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	51	98	40	80	41	81	34	32	35	58	35	84	39	37.33	366
20	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	53	98	40	81	40	80	35	31	36	56	37	82	41	38.00	372
22	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	57	95	43	79	42	78	37	31	36	57	36	80	43	37.83	371
26	58	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	61	98	40	81	40	79	36	30	37	54	39	81	42	39.00	382
30	62	98	40	80	41	80	35	32	35	58	35	82	41	37.83	371

Sample No. 3-L   **Shrinkage of Concrete Beams**   Page 3

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
July 1	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	64	96	42	77	44	78	37	29	38	58	35	78	45	40.17	394
3	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	68	96	42	76	45	77	38	29	38	57	36	75	48	41.17	403
7	69	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	76	93	45	75	46	77	38	29	38	56	37	74	49	42.17	413
15	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	79	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	81	93	45	74	47	77	38	28	39	57	36	76	47	42.00	0 412
20	82	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	84	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	86	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	87	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	88	93	45	73	48	77	38	28	39	56	37	74	49	42.67	418
27	89	93	45	73	48	77	38	28	39	56	37	74	49	42.67	418
28	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	91	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sample No. 3-L Shrinkage of Concrete Beams Page 4

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in. x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
Aug. 1	94	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	95	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	97	92	46	73	48	77	38	27	40	57	36	72	51	43.17	423
5	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	99	90	48	72	49	77	38	26	41	58	35	72	51	43.67	428
7	100	90	48	72	49	76	39	25	42	58	35	72	51	44.00	431
8	101	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	102	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	103	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	104	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	105	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	106	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	107	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	108	90	48	69	52	72	43	24	43	58	35	72	51	45.33	444
16	109	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	110	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	111	90	48	70	51	72	43	23	44	54	39	75	48	45.50	446
19	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	113	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	114	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	115	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	116	0792	46	1271	50	0573	42	0924	43	0754	39	0874	49	44.83	439
24	117	92	46	71	50	73	42	25	42	54	39	72	51	45.00	441
25	118	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	119	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	121	91	47	72	49	73	42	24	43	52	41	72	51	45.50	446

Sample No. 4-L   Shrinkage of Concrete Beams   Page 1

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
May 2	3	1111	-	0646	-	1101	-	0959	-	1052	-	1094	-	-	-
3	4	13	+ 2	50	+ 4	04	+ 3	64	+ 5	55	+ 3	97	+ 3	+ 3.33	+ 33
4	5	11	0	50	+ 4	04	+ 3	60	+ 1	53	+ 1	94	0	+ 1.50	+ 15
5	6	07	4	47	+ 1	01	0	57	2	51	1	91	3	1.50	15
6	7	07	4	47	+ 1	02	+ 1	57	2	51	1	92	2	1.17	11
7	8	07	4	48	+ 2	04	+ 3	57	2	50	2	91	3	1.00	10
8	9	06	5	44	2	1100	1	57	2	48	4	90	4	3.00	30
9	10	04	7	40	6	1097	4	54	5	46	6	87	7	5.83	57
10	11	02	9	40	6	95	6	53	6	44	8	86	8	7.17	70
11	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	14	01	10	40	6	96	5	52	7	43	9	86	8	7.50	74
14	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	16	1094	17	34	12	86	15	48	11	36	16	83	11	13.67	134
16	17	93	18	34	12	87	14	48	11	36	16	80	14	14.17	139
17	18	92	19	33	13	83	18	47	12	35	17	78	16	15.83	155
18	19	92	19	33	13	87	14	46	13	33	19	77	17	15.83	155
19	20	96	15	33	13	86	15	46	13	36	16	79	15	14.50	142
20	21	91	20	33	13	86	15	45	14	35	17	77	17	16.00	157
21	22	92	19	32	14	85	16	44	15	34	18	78	16	16.33	160
22	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	24	90	21	32	14	80	20	42	17	30	22	73	21	19.17	188
24	25	90	21	32	14	83	18	42	17	28	24	72	22	19.33	189
25	26	88	23	30	16	82	19	42	17	29	23	70	24	20.33	199
26	27	87	24	28	18	78	23	41	18	27	25	70	24	22.00	216
27	28	87	24	29	17	81	20	41	18	27	25	70	24	21.33	209
28	29	86	25	28	18	78	23	41	18	26	26	68	26	22.67	222
29	30	86	25	27	19	77	24	39	20	25	27	69	25	23.33	229
30	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sample No. 4-L   Shrinkage of Concrete Beams   Page 2

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
June 1	33	84	27	26	20	78	23	39	20	23	29	68	26	24.17	237
2	34	84	27	23	23	76	25	38	21	22	30	67	27	25.50	250
3	35	82	29	24	22	77	24	37	22	22	30	66	28	25.83	253
4	36	82	29	23	23	76	25	36	23	22	30	66	28	26.33	258
5	37	81	30	22	24	74	27	35	24	21	31	65	29	27.50	270
6	38	81	30	22	24	72	29	33	26	20	32	64	30	28.50	279
7	39	79	32	19	27	71	30	33	26	19	33	61	33	30.17	296
8	40	78	33	18	28	71	30	33	26	17	35	62	32	30.67	301
9	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	42	78	33	17	29	71	30	33	26	19	33	63	31	30.33	297
11	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	44	81	30	21	25	75	26	35	24	20	32	64	30	27.83	273
13	45	81	30	21	25	76	25	35	24	18	34	63	31	28.17	276
14	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	47	77	34	21	25	73	28	31	28	19	33	63	31	29.83	292
16	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	49	79	32	21	25	72	29	33	26	17	35	61	33	30.00	294
18	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	51	78	33	18	28	72	29	32	27	16	36	60	34	31.17	305
20	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	53	76	35	17	29	72	29	31	28	15	37	60	34	32.00	314
22	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	57	75	36	16	30	72	29	31	28	16	36	58	36	32.5	319
26	58	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	61	77	34	15	31	70	31	31	28	16	36	59	35	32.5	319
30	62	80	31	17	29	73	28	35	24	15	37	61	33	30.33	297

Sample No. 4-L   Shrinkage of Concrete Beams   Page 3

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in. x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
July 1	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	64	80	31	16	30	72	29	32	27	14	38	57	37	32.0	314
3	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	68	79	32	15	31	71	30	32	27	14	38	56	38	32.67	320
7	69	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	73	-	--	-	-	-	-	-	-	-	-	-	-	-	-
12	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	76	78	33	15	31	70	31	29	30	14	38	55	39	33.67	330
15	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	79	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	81	78	33	14	32	70	31	30	29	13	39	55	39	33.83	332
20	82	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	84	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	86	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	87	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	88	78	33	13	33	70	31	29	30	13	39	55	39	34.17	335
27	89	78	33	13	33	70	31	29	30	14	38	55	39	34.00	333
28	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	91	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sample No. 4-L　　Shrinkage of Concrete Beams　　

Date	Age-- Days	Set # 1		Set # 2		Set # 3		Set # 4		Set # 5		Set # 6		Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
		Reading	Accum. Diff.	Reading	Accum. Diff.	Reading	Accum. Diff.	Reading	Accum. Diff.	Reading	Accum. Diff.	Reading	Accum. Diff.		
Aug. 1	94	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	95	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	97	77	34	14	32	69	32	28	31	10	42	55	39	35.00	343
5	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	99	77	34	14	32	69	32	28	31	10	42	55	39	35.00	343
7	100	77	34	14	32	69	32	27	32	10	42	54	40	35.33	346
8	101	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	102	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	103	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	104	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	105	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	106	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	107	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	108	77	34	14	32	68	33	27	32	10	42	55	39	35.33	346
16	109	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	110	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	111	77	34	13	33	68	33	25	34	10	42	55	39	35.83	351
19	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	113	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	114	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	115	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	116	1078	33	0614	32	1066	35	0926	33	1014	38	1054	40	35.17	345
24	117	74	37	14	31	67	34	26	33	14	38	56	38	35.17	345
25	118	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	119	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	121	75	36	12	34	66	35	26	33	14	38	55	39	35.83	351

Sample No. 5-L   **Shrinkage of Concrete Beams**   Page 1

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
May 2	3	1043	-	0673	-	1197	-	0718	-	1118	-	0902	-	-	-
3	4	46	+ 3	74	+ 1	1202	+ 5	21	+ 3	18	0	05	+ 3	+ 2.5	+ 25
4	5	32	1	71	2	01	+ 4	19	+ 1	15	3	03	+ 1	0	0
5	6	40	3	70	3	1198	+ 1	18	0	12	6	02	0	1.83	18
6	7	40	3	70	3	98	+ 1	18	0	11	7	02	0	2.00	20
7	8	40	3	70	3	97	0	18	0	11	7	01	1	2.33	23
8	9	38	5	68	5	95	2	15	3	13	5	0897	5	4.17	41
9	10	36	7	66	7	92	5	13	5	11	7	96	6	6.17	60
10	11	34	9	65	8	90	7	12	6	08	10	95	7	7.83	76
11	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	14	33	10	66	7	90	7	11	7	08	10	95	7	8.00	78
14	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	16	27	16	61	12	84	13	05	13	04	14	89	13	13.50	132
16	17	28	15	60	13	84	13	04	14	04	14	90	12	13.50	132
17	18	27	16	60	13	83	14	02	16	04	14	88	14	14.50	142
18	19	26	17	61	12	80	17	02	16	03	15	88	14	15.17	149
19	20	28	15	61	12	80	17	01	17	02	16	88	14	15.17	149
20	21	27	16	61	12	81	16	0700	18	02	16	87	15	15.50	152
21	22	26	17	60	13	80	17	01	17	01	17	87	15	16.00	157
22	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	24	20	23	48	15	75	22	0699	19	1100	18	87	15	18.67	183
24	25	21	22	59	14	76	21	0700	18	1100	18	85	17	16.33	160
25	26	20	23	57	16	75	22	0699	19	1100	18	83	19	19.50	191
26	27	19	24	58	15	75	22	98	20	1099	19	81	21	20.17	198
27	28	19	24	57	16	75	22	98	20	1100	18	83	19	19.83	194
28	29	18	25	57	16	74	23	97	21	1100	18	81	21	20.67	203
29	30	17	26	56	17	74	23	96	22	1099	19	80	22	21.50	211
30	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sample No.______ Shrinkage of Concrete Beams

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
June 1	33	19	24	55	18	74	23	96	22	98	20	79	23	21.67	212
2	34	17	26	54	19	72	25	96	22	99	19	79	23	22.33	219
3	35	16	27	53	20	72	25	96	22	97	21	78	24	23.17	227
4	36	16	27	52	21	70	27	95	23	97	21	78	24	23.83	234
5	37	16	27	52	21	71	26	93	25	96	22	77	25	24.33	238
6	38	15	28	51	22	69	28	91	27	94	24	74	28	26.17	256
7	39	14	29	49	24	68	29	91	27	92	26	75	27	27.00	265
8	40	14	29	49	24	68	29	91	27	92	26	77	25	26.67	261
9	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	42	14	29	49	24	68	29	91	27	94	24	74	28	26.83	263
11	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	44	15	28	49	24	71	26	94	24	94	24	76	26	25.33	248
13	45	15	28	51	22	71	26	93	25	94	24	75	27	25.33	248
14	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	47	15	28	48	25	70	27	92	26	93	25	74	28	26.50	260
16	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	49	14	29	48	25	69	28	93	25	92	26	74	28	26.83	263
18	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	51	15	28	50	23	71	26	91	27	92	26	75	27	26.17	256
20	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	53	16	27	49	24	70	27	91	27	90	28	72	30	27.17	266
22	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	57	13	30	48	25	66	31	89	29	89	29	72	30	29.00	284
26	58	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	61	15	28	47	26	68	29	90	28	90	28	73	29	28.00	274
30	62	17	26	49	24	70	27	93	25	91	27	72	30	26.50	260

Sample No. 5-L   Shrinkage of Concrete Beams   Page 3

Date	Age-- Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
July 1	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	64	16	27	49	24	69	28	91	27	91	27	72	30	27.17	266
3	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	68	15	28	47	26	68	29	90	28	91	27	69	33	28.50	279
7	69	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	76	15	28	46	27	68	29	89	29	91	27	69	33	28.83	283
15	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	79	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	81	15	28	45	28	67	30	88	30	89	29	69	33	29.67	291
20	82	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	84	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	86	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	87	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	88	15	28	44	29	66	31	87	31	88	30	69	33	30.33	297
27	89	15	28	43	30	66	31	87	31	88	30	68	34	30.67	301
28	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	91	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sample No. 5-L   Shrinkage of Concrete Beams   Page 4

Date	Age--Days	Set # 1 Reading	Set # 1 Accum. Diff.	Set # 2 Reading	Set # 2 Accum. Diff.	Set # 3 Reading	Set # 3 Accum. Diff.	Set # 4 Reading	Set # 4 Accum. Diff.	Set # 5 Reading	Set # 5 Accum. Diff.	Set # 6 Reading	Set # 6 Accum. Diff.	Average Diff. in.x 10^{-4}	Unit Shrinkage "/" x 10^{-6}
Aug. 1	94	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	95	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	97	14	29	42	31	65	32	86	32	87	31	67	35	31.67	310
5	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	99	13	30	41	32	65	32	84	34	85	32	66	36	32.67	320
7	100	13	30	40	33	65	32	84	34	84	33	66	36	33.00	323
8	101	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	102	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	103	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	104	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	105	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	106	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	107	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	108	13	30	38	35	65	32	83	35	84	33	66	36	33.50	328
16	109	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	110	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	111	13	30	37	36	68	29	82	36	85	32	66	36	33.17	325
19	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	113	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	114	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	115	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	116	1014	29	0637	36	1169	28	0682	36	1080	37	0864	38	34.00	333
24	117	14	29	38	35	68	29	82	36	84	33	64	38	33.33	327
25	118	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	119	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	121	14	29	38	35	65	32	82	36	82	35	63	38	34.17	335

Creep of Concrete

Sample No. 3-L-3

Date Poured April 29/59

Age at loading 3 days

Age at unloading

Compressive strength 1008 psi

Stress applied 455 psi

Initial deformation 1406×10^{-6} in/in

Initial recovery 325×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
						02010			
May	2	Initial	75	64	55	12822	10812	.001406	2048
	3	1	74	68	74	13592	770	100	123
	4	2	74	67	70	14113	1291	168	189
	5	3	74	63	54	14521	1699	221	247
	6	4	75	66	63	14859	2037	265	274
	7	5	75	66	63	15183	2361	307	326
	8	6	75	64	55	15383	2561	333	341
	9	7	74	66	66	15600	2778	361	394
	10	8	74	66	66	15805	2983	388	426
	11	9	74	66	66	16092	3270	425	-
	12	10	75	65	59	16324	3502	455	448
	13	11	75	62	48	16495	3673	477	-
	14	12	75	63	51	17579	4757	618	490
	15	13	-	-	-	17765	4943	643	-
	16	14	75	64	55	17950	5128	667	-
	17	15	75	64	55	18089	5267	685	-
	18	16	75	64	55	18350	5528	719	615
	19	17	75	65	59	18350	5528	719	627
	20	18	75	65	59	18542	5720	743	632
	21	19	75	65	59	18832	6010	781	635
	22	20	-	-	-	-	-	-	-
	23	21	75	63	51	19248	6426	835	811
	24	22	75	64	55	19389	6567	854	826
	25	23	75	62	48	19585	6763	879	730
	26	24	75	62	48	20481	7659	996	963
	27	25	75	67	66	20579	7757	1008	973
	28	26	75	64	55	20800	7978	1037	1002
	29	27	75	64	55	20850	8028	1044	1007
	30	28	75	64	55	20870	8048	1046	-
	31	29	-	-	-	-	-	-	-
June	1	30	75	65	59	21057	8235	1071	1017
	2	31	75	65	59	21198	8376	1089	1022
	3	32	75	65	59	21297	8475	1102	1027
	4	33	75	65	59	21390	8568	1114	1031
	5	34	75	65	59	21550	8728	1135	1112
	6	35	75	65	59	21625	8803	1144	1127
	7	36	75	65	59	22202	9380	1219	1210
	8	37	75	64	55	22311	9489	1234	1215
	9	38	75	65	59	22300	9578	1245	-
	10	39	75	66	63	22499	9677	1258	1215
	11	40	75	66	63	22523	9701	1271	-
	12	41	75	68	70	22500	9678	1258	1227

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June	13	42	75	65	59	22525	9703	1261	1230
	14	43	75	68	70	22500	9678	1258	-
	15	44	75	65	59	22601	9779	1271	1274
	16	45	75	68	70	22670	9848	1280	-
	17	46	75	66	63	22706	9884	1285	1286
	18	47	75	66	63	22743	9921	1290	-
	19	48	75	65	59	22830	10008	1301	1289
	20	49	75	64	55	22940	10118	1315	-
	21	50	75	65	59	23011	10189	1325	1296
	22	51	75	68	70	23140	10318	1341	-
	23	52	75	64	59	23221	10399	1352	-
	24	53	75	64	59	23302	10480	1362	-
	25	54	75	64	59	23405	10583	1376	1340
	26	55	75	63	51	23510	10688	1389	-
	27	56	75	67	66	23435	10613	1380	-
	28	57	75	67	66	23330	10508	1366	-
	29	58	75	65	59	23251	10429	1356	1311
	30	59	75	67	66	23237	10415	1354	1316
July	1	60	75	65	59	23400	10578	1375	-
	2	61	75	61	44	23479	10657	1385	1323
	3	62	75	62	48	23479	10657	1385	-
	4	63	-	-	-	-	-	-	-
	5	64	75	67	66	23716	10894	1416	-
	6	65	75	65	59	23875	11053	1437	1340
	7	66	75	63	51	23930	11108	1444	-
	8	67	75	64	55	23980	11158	1451	-
	9	68	-	-	-	-	-	-	-
	10	69	75	65	59	24033	11211	1457	-
	11	70	75	65	59	24170	11348	1475	-
	12	71	75	65	59	24290	11468	1491	-
	13	72	77	65	52	24386	11564	1503	-
	14	73	77	67	60	24432	11610	1509	1355
	15	74	75	75	100	24153	11331	1473	-
	16	75	75	72	86	24010	11188	1454	-
	17	76	76	67	63	24111	11289	1468	-
	18	77	76	67	63	24210	11388	1480	-
	19	78	77	67	60	24290	11468	1491	1357
	20	79	77	66	56	24410	11588	1506	-
	21	80	76	67	63	24440	11618	1510	-
	22	81	76	66	59	24487	11665	1516	-
	23	82	77	68	63	24545	11723	1524	-
	24	83	78	68	60	24593	11771	1530	-
	25	84	77	66	56	24700	11878	1544	-
	26	85	77	65	52	24718	11896	1546	1374
	27	86	76	67	55	24750	11928	1551	1382
	28	87	75	65	59	24872	12050	1567	-
	29	88	75	65	59	24844	12022	1563	-
	30	89	75	65	59	24815	11993	1559	-
	31	90	75	67	66	24775	11953	1554	-
Aug.	1	91	-	-	-	-	-	-	-
	2	92	75	63	51	24761	11939	1552	-

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
Aug.	3	93	75	65	59	24788	11966	1556	-
	4	94	75	65	59	24823	12001	1560	1384
	5	95	75	64	55	24920	12098	1573	-
	6	96	75	65	59	24950	12128	1577	1419
	7	97	75	65	59	24999	12177	1583	1419
	8	98	76	65	55	00035	12213	1588	-
	9	99	75	66	63	00100	12278	1596	-
	10	100	75	65	59	00095	12273	1595	-
	11	101	75	64	55	00121	12299	1599	-
	12	102	75	65	59	00160	12338	1604	-
	13	103	75	64	55	00168	12346	1605	-
	14	104	75	64	55	-	-	-	-
	15	105	75	64	55	00160	12338	1604	1472
	16	106	74	64	58	00141	12319	1601	-
	17	107	74	64	58	00134	12312	1601	-
	18	108	74	65	65	00101	12279	1596	1477
	19	109	73	64	61	00100	12278	1596	-
	20	110	74	64	61	00090	11278	1595	-
	21	111	72	64	65	00052	12230	1590	-
	22	112	-	-	-	-	-	-	-
	23	113	71	63	69	24985	12163	1581	1480
	24	114	71	64	69	24947	12125	1576	1480
	25	115	71	63	64	24949	12127	1577	--
	26	116	71	63	64	24948	12126	1576	-
	27	117	71	63	64	24953	12131	1577	-
	28	118	74	63	54	25165	12343	1605	1490
	29	119	74	63	54	25173	12350	1606	-
	30	120	-	-	-	-	-	-	-
	31	121	74	64	58	21370	8548	1111-	-
Sept.	1	122	74	63	54	21365	8543	1111	-
	2	123	74	64	58	21339	8517	1107	-
	3	124	74	64	58	21305	8483	1103	-
	4	125	74	64	58	21282	8460	1100	-
	5	126	-	-	-	-	-	-	-
	6	127	-	-	-	-	-	-	-
	7	128	74	62	51	21328	8506	1106	-
	8	129	-	-	-	-	-	-	-
	9	130	74	64	58	21242	8420	1095	-
	10	131	74	63	54	21152	8330	1083	-
	11	132	74	63	54	21168	8346	1085	-
	12	133	-	-	-	-	-	-	-
	13	134	74	65	62	1132	8310	1080	-

Sample No. 3-L-7

Date Poured April 29/59

Age at loading 7 days

Age at unloading

Compressive strength 1699 psi

Stress applied 782 psi

Initial deformation 1760×10^{-6} in/in

Initial recovery 687×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
						00488			
May	6	Initial	75	66	63	14030	13542	.001760	2122
	7	1	75	66	63	14255	225	29	304
	8	2	75	64	55	16522	2492	324	348
	9	3	74	66	66	16945	2915	379	407
	10	4	74	66	66	17304	3274	426	443
	11	5	74	66	66	17735	3705	482	----
	12	6	75	65	59	18026	3996	519	470
	13	7	75	62	48	18346	4316	561	475
	14	8	75	63	51	18598	4568	594	524
	15	9	-	-	-	18825	4795	623	----
	16	10	75	64	55	19029	4999	650	----
	17	11	75	64	55	19210	5180	673	----
	18	12	75	64	55	19472	5442	707	657
	19	13	75	65	59	19512	5482	713	674
	20	14	75	65	59	19713	5683	739	674
	21	15	75	65	59	19825	5795	753	----
	22	16	-	-	-	-	-	-	----
	23	17	75	63	51	21532	7502	975	1061
	24	18	75	64	55	21776	7746	1007	1085
	25	19	75	62	48	22099	8069	1049	1090
	26	20	75	62	48	22375	8345	1084	1154
	27	21	75	67	66	22456	8426	1095	1166
	28	22	75	64	55	22704	8674	1128	1188
	29	23	75	64	55	22747	8717	1133	1196
	30	24	75	64	55	22750	8720	1134	----
	31	25	-	-	-	-	-	-	----
June	1	26	75	65	59	22961	8931	1161	1218
	2	27	75	65	59	23111	9081	1181	1232
	3	28	75	65	59	23232	9202	1196	1240
	4	29	75	65	59	23330	9300	1209	1245
	5	30	75	65	59	23487	9457	1229	1370
	6	31	75	65	59	23615	9585	1246	1382
	7	32	75	65	59	24601	10571	1374	1514
	8	33	75	64	55	24770	10740	1396	1517
	9	34	75	65	59	24939	10909	1418	----
	10	35	75	66	63	00067	11037	1435	1524
	11	36	75	66	63	00109	11079	1440	----
	12	37	75	68	70	20546	11079	1440	1524
	13	38	75	65	59	20608	11141	1448	1534
	14	39	75	68	70	20567	11100	1443	----
	15	40	75	65	59	20687	11210	1457	1585
	16	41	75	68	70	20748	11281	1467	----

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June	17	42	75	66	63	20798	11331	1473	1602
	18	43	75	66	63	20848	11381	1480	-
	19	44	75	65	59	20945	11478	1492	1619
	20	45	75	64	55	21071	11604	1509	-
	21	46	75	65	59	21168	11701	1521	1635
	22	47	75	68	70	21308	11841	1539	-
	23	48	75	64	55	21408	11941	1552	-
	24	49	75	64	55	21494	12027	1564	-
	25	50	75	64	55	21598	12131	1577	1668
	26	51	75	63	51	21705	12238	1591	-
	27	52	75	67	66	21643	12176	1583	-
	28	53	75	67	66	21584	12117	1575	-
	29	54	75	65	59	21545	12078	1570	1668
	30	55	75	67	66	21556	12089	1572	1649
July	1	56	75	65	59	21707	12240	1591	-
	2	57	75	61	44	21788	12321	1602	1676
	3	58	75	62	48	21799	12332	1603	-
	4	59	-	-	-	-	-	-	-
	5	60	75	67	66	22068	12601	1638	-
	6	61	75	65	59	22233	12766	1660	1690
	7	62	75	63	51	22313	12846	1670	θ
	8	63	75	64	55	22365	12898	1677	-
	9	64	-	-	-	-	-	-	-
	10	65	75	65	59	22433	12966	1686	-
	11	66	75	65	59	22530	13063	1698	-
	12	67	75	65	59	22630	13163	1711	-
	13	68	77	65	52	22717	13250	1723	-
	14	69	77	67	60	22785	13318	1731	1720
	15	70	75	75	100	22618	13151	1710	-
	16	71	75	72	86	22527	13060	1698	-
	17	72	76	67	63	22644	13177	1713	-
	18	73	76	67	63	22711	13244	1722	-
	19	74	77	67	60	22780	13313	1731	1735
	20	75	77	66	56	22880	13413	1744	-
	21	76	76	67	63	22923	13456	1749	-
	22	77	76	66	59	22971	13504	1756	-
	23	78	77	68	63	23027	13560	1763	-
	24	79	78	68	60	23065	13598	1768	-
	25	80	77	66	56	23190	13723	1784	-
	26	81	77	65	52	23204	13737	1786	1757
	27	82	76	65	55	23269	13802	1794	1764
	28	83	75	65	59	23349	13882	1805	-
	29	84	75	65	59	23351	13884	1805	-
	30	85	75	65	59	23338	13871	1803	-
	31	86	75	67	66	23315	13848	1800	-
Aug.	1	87	-	-	-	-	-	-	-
	2	88	75	63	51	23320	13853	1801	-
	3	89	75	65	59	23350	13883	1805	-
	4	90	75	65	59	23369	13902	1807	1769

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
Aug.	5	91	75	64	55	23521	14054	1827	-
	6	92	75	65	59	23548	14081	1831	1894
	7	93	75	65	59	23590	14123	1836	1894
	8	94	76	65	55	23622	14155	1840	-
	9	95	75	66	63	23663	14196	1845	-
	10	96	75	65	59	23658	14191	1845	-
	11	97	75	64	55	23710	14243	1852	-
	12	98	75	65	59	23765	14298	1859	-
	13	99	75	64	55	23785	14318	1861	-
	14	100	75	64	55	-	-	-	-
	15	101	75	64	55	23785	14318	1861	1950
	16	102	74	64	58	23778	14311	1860	-
	17	103	74	64	58	23779	14312	1861	-
	18	104	73	65	65	23762	14295	1858	1950
	19	105	73	64	61	23776	14309	1860	-
	20	106	73	64	61	23774	14307	1860	-
	21	107	72	64	65	23752	14285	1857	-
	22	108	-	-	-	-	-	-	-
	23	109	71	64	69	23713	14246	1852	1945
	24	110	71	64	69	23689	14222	1849	1945
	25	111	71	63	64	23700	14233	1850	-
	26	112	71	63	64	23705	14238	1851	-
	27	113	71	63	64	23715	14248	1852	-
	28	114	74	63	54	23850	14383	1870	1955
	29	115	74	63	54	23893	14426	1875	-
	30	116	-	-	-	-	-	-	-
	31	117	74	64	58	17974	8507	1106	-
Sept.	1	118	74	63	54	17944	8477	1102	-
	2	119	74	64	58	17897	8430	1096	-
	3	120	74	64	58	17859	8392	1091	-
	4	121	74	64	58	17828	8361	1087	
	5	122	-	-	-	-	-	-	-
	6	123	-	-	-	-	-	-	-
	7	124	74	62	51	17820	8353	1086	-
	8	125	-	-	-	-	-	-	-
	9	126	74	64	58	17732	8265	1074	-
	10	127	74	63	54	17710	8343	1072	-
	11	128	74	63	54	17700	8333	1070	-
	12	129	-	-	-	-	-	-	-
	13	130	74	65	62	17653	8186	1064	-

Creep of Concrete

Sample No. 3-L29

Date Poured April 29/59

Age at loading 29 days

Age at unloading

Compressive strength 2481 psi

Stress applied 1155 psi

Initial deformation 1280×10^{-6} in/in

Initial recovery 815×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
						01482			*
May	28	Initial	75	64	55	11326	9844	1280	1370
	29	1	75	64	55	11620	294	38	149
	30	2	75	64	55	11988	662	86	-
	31	-	-	-	-	-	-	-	-
June	1	4	75	65	59	12518	1192	155	208
	2	5	75	65	59	13255	1929	251	203
	3	6	75	65	59	13519	2193	285	194
	4	7	75	65	59	13707	2383	310	213
	5	8	75	65	59	13976	2650	345	407
	6	9	75	65	59	14163	2837	369	333
	7	10	75	65	59	14648	3322	432	421
	8	11	75	64	55	14831	3505	456	431
	9	12	75	65	59	15040	3714	483	-
	10	13	75	66	63	15193	3867	503	441
	11	14	75	66	63	15352	3926	510	-
	12	15	75	68	70	15290	3964	515	441
	13	16	75	65	59	15378	4052	527	439
	14	17	75	68	70	15636	4310	560	-
	15	18	75	65	59	15798	4472	581	593
	16	19	75	68	70	15091	4575	595	-
	17	20	75	66	63	15973	4647	604	519
	18	21	75	66	63	16045	4719	613	-
	19	22	75	65	59	16162	4836	629	527
	20	23	75	64	55	16882	4956	644	-
	21	24	75	65	59	16405	5079	660	534
	22	25	75	68	70	16566	5240	681	-
	23	26	75	64	55	16684	5358	697	-
	24	27	75	64	55	16784	5458	710	-
	25	28	75	64	55	16968	5642	733	566
	26	29	75	63	51	17062	5736	746	-
	27	30	75	67	66	17012	5686	739	-
	28	31	75	67	66	16970	5644	734	-
	29	32	75	65	59	16942	5616	730	556
	30	33	75	67	66	16957	5631	732	554
July	1	34	75	65	59	17124	5798	754	-
	2	35	75	61	44	17210	5884	765	561
	3	36	75	62	48	17221	5895	766	-
	4	37	-	-	-	-	-	-	-
	5	38	75	67	66	17482	6156	800	-
	6	39	75	65	59	17655	6329	823	573
	7	40	75	63	51	17738	6412	834	-
	8	41	75	64	55	17795	6469	841	-

* Demec gauge points very poor.

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
July	9	42	-	-	-	-	-	-	-
	10	43	75	65	59	17908	6582	856	-
	11	44	75	65	59	18009	6683	869	-
	12	45	75	65	59	18124	6798	884	-
	13	46	77	65	52	18214	6888	895	-
	14	47	77	67	60	18290	6964	905	581
	15	48	75	75	100	18151	6825	887	-
	16	49	75	72	86	18075	6749	877	-
	17	50	76	67	63	18189	6863	892	-
	18	51	76	67	63	18265	6939	902	-
	19	52	77	67	60	18330	7004	911	590
	20	53	77	66	56	18431	7105	924	-
	21	54	76	67	63	18483	7157	930	-
	22	55	76	66	59	18534	7208	937	-
	23	56	77	68	63	18600	7274	946	-
	24	57	78	68	60	18638	7312	951	-
	25	58	77	66	56	18758	7432	966	-
	26	59	77	65	52	18775	7449	968	610
	27	60	76	65	55	18853	7527	979	617
	28	61	75	65	59	18915	7589	987	-
	29	62	75	65	59	18938	7612	990	-
	30	63	75	65	59	18930	7604	989	-
	31	64	75	67	66	18919	7593	987	-
Aug.	1	65	-	-	-	-	-	-	-
	2	66	75	63	51	18928	7602	988	-
	3	67	75	65	59	18959	7633	992	-
	4	68	75	65	59	18982	7656	995	625
	5	69	75	64	55	19137	7811	1015	-
	6	70	75	65	59	19167	7841	1019	693
	7	71	75	65	59	19210	7884	1025	693
	8	72	76	65	55	19235	7909	1028	-
	9	73	75	66	63	19291	7965	1035	-
	10	74	75	65	59	19291	7965	1035	-
	11	75	75	64	55	19355	8029	1044	-
	12	76	75	65	59	19410	8084	1051	-
	13	77	75	64	55	19429	8103	1053	-
	14	78	75	64	55	-	-	-	-
	15	79	75	64	55	19429	8103	1053	1002
	16	80	75	64	58	19328	8102	1053	-
	17	81	74	64	58	19431	8105	1054	-
	18	82	74	65	65	19419	8093	1052	1005
	19	83	73	64	61	19438	8112	1055	-
	20	84	73	64	61	19438	8112	1055	-
	21	85	72	64	65	19423	8097	1053	-
	22	86	-	-	-	-	-	-	-
	23	87	71	64	69	19397	8071	1049	995
	24	88	71	64	69	19373	8047	1046	995
	25	89	71	63	64	19383	8057	1047	-

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
Aug.	26	90	71	63	64	19390	8064	1048	-
	27	91	71	63	64	19401	8075	1050	-
	28	92	74	63	54	19541	8215	1068	1005
	29	93	74	63	54	19578	8252	1073	-
	30	94	-	-	-	-	-	-	-
	31	95	74	64	58	12642	1316	171	-
Sept.	1	96	74	63	54	12615	1289	168	-
	2	97	74	64	58	12571	1245	162	-
	3	98	74	64	58	12541	1215	158	-
	4	99	74	64	58	12511	1185	154	-
	5	100	-	-	-	-	-	-	-
	6	101	-	-	-	-	-	-	-
	7	102	74	62	51	12502	1176	153	-
	8	103	-	-	-	-	-	-	-
	9	104	74	64	58	12429	1103	142	-
	10	105	74	63	54	12405	1079	140	--
	11	106	74	63	54	12394	1068	139	-
	12	107	-	-	-	-	-	-	-
	13	108	74	65	62	12352	1026	133	-

Creep of Concrete

Sample No. 4-L-3

Date Poured April 29/59

Age at loading 3 days

Age at unloading

Compressive strength 2120 psi

Stress applied 961 psi

Initial deformation 839×10^{-6} in/in

Initial recovery 632×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
						02953			*
May	2	Initial	75	64	55	09403	6450	.000839	1299
	3	1	74	68	74	10835	1432	186	174
	4	2	74	67	70	11571	2168	282	309
	5	3	74	63	54	12103	2700	351	375
	6	4	75	66	63	12565	3162	411	412
	7	5	75	66	63	12939	3536	460	461
	8	6	75	64	55	13166	3763	489	436
	9	7	74	66	66	13417	4014	522	505
	10	8	74	66	66	13629	4226	549	519
	11	9	74	66	66	13918	4515	587	-
	12	10	75	65	59	14152	4749	617	537
	13	11	75	62	48	14330	4927	641	-
	14	12	75	63	51	15080	5677	738	539
	15	13	-	-	-	15240	5837	759	-
	16	14	75	64	55	15405	6002	780	-
	17	15	75	64	55	15514	6111	794	-
	18	16	75	64	55	15729	6326	822	696
	19	17	75	65	59	15676	6273	815	715
	20	18	75	65	59	15845	6442	837	720
	21	19	75	65	59	16083	6680	868	725
	22	20	-	-	-	-	-	-	-
	23	21	75	63	51	16337	6934	901	811
	24	22	75	64	55	16441	7038	915	848
	25	23	75	62	48	16642	7239	941	865
	26	24	75	62	48	17564	8161	1061	973
	27	25	75	67	66	17600	8197	1066	1014
	28	26	75	64	55	17868	8465	1099	1022
	29	27	75	64	55	17885	8482	1103	1017
	30	28	75	64	55	17852	8449	1098	-
	31	29	-	-	-	-	-	-	-
June	1	30	75	65	59	18008	8605	1119	1039
	2	31	75	65	59	18129	8726	1134	1041
	3	32	75	65	59	18220	8817	1146	1049
	4	33	75	65	59	18289	8886	1155	1046
	5	34	75	65	59	18420	9017	1172	1078
	6	35	75	65	59	18485	9082	1181	1073
	7	36	75	65	59	18958	9555	1242	1149
	8	37	75	64	55	19050	9647	1254	1120
	9	38	75	65	59	19112	9709	1262	-
	10	39	75	66	63	19181	9778	1271	1142
	11	40	75	66	63	19180	9777	1271	-
	12	41	75	68	70	19130	9727	1265	1142

* Two sets gage holes poor.

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June	13	42	75	65	59	19153	9750	1268	1144
	14	43	75	68	70	19292	9889	1286	-
	15	44	75	65	59	19398	9995	1299	1196
	16	45	75	68	70	19446	10043	1306	-
	17	46	75	66	63	19479	10076	1310	1201
	18	47	75	66	63	19501	10098	1313	-
	19	48	75	65	59	19580	10177	1323	1191
	20	49	75	64	55	19675	10272	1335	-
	21	50	75	65	59	19715	10312	1341	1232
	22	51	75	68	70	19833	10430	1356	-
	23	52	75	64	59	19913	10510	1366	-
	24	53	75	64	59	19982	10579	1375	-
	25	54	75	64	59	20060	10657	1385	1245
	26	55	75	63	51	20147	10744	1397	-
	27	56	75	67	66	20042	10639	1383	-
	28	57	75	67	66	19943	10540	1370	-
	29	58	75	65	59	19871	10468	1361	1235
	30	59	75	67	66	19868	10465	1360	1232
July	1	60	75	65	59	20023	10620	1381	-
	2	61	75	61	44	20083	10680	1388	1237
	3	62	75	62	48	20079	10676	1388	-
	4	63	-	-	-	-	-	-	-
	5	64	75	67	66	20299	10896	1416	-
	6	65	75	65	59	20439	11036	1435	1245
	7	66	75	63	51	20492	11089	1442	-
	8	67	75	64	55	20518	11115	1445	-
	9	68	-	-	-	-	-	-	-
	10	69	75	65	59	20550	11147	1449	-
	11	70	75	65	59	20641	11238	1461	-
	12	71	75	65	59	20709	11306	1470	-
	13	72	77	65	52	20778	11375	1479	-
	14	73	77	67	60	20822	11419	1484	1294
	15	74	75	75	100	20580	11177	1453	-
	16	75	75	72	86	20465	11062	1438	-
	17	76	76	67	63	20582	11179	1453	-
	18	77	76	67	63	20653	11251	1463	-
	19	78	77	67	60	20715	11312	1471	1301
	20	79	77	66	56	20808	11405	1483	-
	21	80	76	67	63	20832	11429	1486	-
	22	81	76	66	59	20872	11469	1491	-
	23	82	77	68	63	20921	11518	1497	-
	24	83	78	68	60	20954	11551	1502	-
	25	84	77	66	56	21054	11651	1515	-
	26	85	77	65	52	21076	11673	1517	1318
	27	86	76	67	55	21129	11726	1524	1325
	28	87	75	65	59	21130	11727	1525	-
	29	88	75	65	59	21295	11892	1546	-
	30	89	75	65	59	21270	11867	1543	-
	31	90	75	67	66	21239	11836	1539	-
Aug.	1	91	-	-	-	-	-	-	-
	2	92	75	63	51	21220	11817	1536	-

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
Aug.	3	93	75	65	59	21250	11847	1540	-
	4	94	75	65	59	21275	11872	1543	1330
	5	95	75	64	55	21400	11997	1560	-
	6	96	75	65	59	21421	12018	1562	1345
	7	97	75	65	59	21457	12054	1567	1348
	8	98	76	65	55	21483	12080	1570	-
	9	99	75	66	63	21490	12087	1571	-
	10	100	75	65	59	21499	12096	1572	-
	11	101	75	64	55	21529	12126	1576	-
	12	102	75	65	59	21580	12177	1583	-
	13	103	75	64	55	21586	12183	1584	-
	14	104	75	64	55	-	-	-	-
	15	105	75	64	55	21587	12184	1584	1382
	16	106	74	64	58	21580	12177	1583	-
	17	107	74	64	58	21583	12180	1583	-
	18	108	73	65	65	21567	12164	1581	1389
	19	109	73	64	61	21578	12175	1583	-
	20	110	73	64	61	21573	12170	1582	-
	21	111	72	64	65	21553	12150	1580	-
	22	112	-	-	-	-	-	-	-
	23	113	71	63	69	21514	12111	1574	1399
	24	114	71	64	69	21482	12079	1570	1397
	25	115	71	63	64	21489	12086	1571	-
	26	116	71	63	64	21492	12089	1572	-
	27	117	71	63	64	21504	12101	1573	-
	28	118	74	63	54	21635	12232	1590	1404
	29	119	74	63	54	21650	12247	1592	-
	30	120	-	-	-	-	-	-	-
	31	121	74	64	58	16302	6899	897	-
Sept.	1	122	74	63	54	16301	6898	897	-
	2	123	74	64	58	16282	6879	894	-
	3	124	74	64	58	16262	6859	892	-
	4	125	74	64	58	16245	6842	889	-
	5	126	-	-	-	-	-	-	-
	6	127	-	-	-	-	-	-	-
	7	128	74	62	51	16325	6832	888	-
	8	129	-	-	-	-	-	-	-
	9	130	74	64	58	16218	6815	886	-
	10	131	74	63	54	16202	6799	884	-
	11	132	74	63	54	16200	6797	884	-
	12	133	-	-	-	-	-	-	-
	13	134	74	65	62	16172	6779	880	-

Creep of Concrete

Sample No. 4-L-7

Date Poured April 29/59

Age at loading 7 Days

Age at unloading

Compressive strength 3645 psi

Stress applied 1656 psi

Initial deformation 1570×10^{-6} in/in

Initial recovery 1152×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
						00665			
May	6	Initial	75	66	63	12740	12075	1570	1686
	7	1	75	66	63	14387	1647	214	429
	8	2	75	64	55	14945	2205	287	453
	9	3	74	66	66	15492	2752	358	534
	10	4	74	66	66	15934	3194	415	598
	11	5	74	66	66	16506	3766	490	-
	12	6	75	65	59	16872	4132	537	603
	13	7	75	62	48	17275	4535	590	613
	14	8	75	63	51	17565	4825	627	666
	15	9	-	-	-	17825	5085	661	-
	16	10	75	64	55	18067	5327	693	-
	17	11	75	64	55	18272	5532	719	-
	18	12	75	64	55	18589	5849	760	875
	19	13	75	65	59	18642	5902	767	904
	20	14	75	65	59	18879	6139	798	887
	21	15	75	65	59	19104	6364	827	-
	22	16	-	-	-	-	-	- -	-
	23	17	75	63	51	20939	8199	1066	1210
	24	18	75	64	55	21189	8449	1098	1247
	25	19	75	62	48	21505	8765	1139	1247
	26	20	75	62	48	21752	9012	1172	1303
	27	21	75	67	66	21804	9064	1178	1321
	28	22	75	64	55	22070	9330	1213	1343
	29	23	75	64	55	22114	9374	1219	1355
	30	24	75	64	55	22112	9372	1218	-
	31	25	-	-	-	-	-	-	-
June	1	26	75	65	59	22330	9590	1247	1365
	2	27	75	65	59	22502	9762	1269	1379
	3	28	75	65	59	22627	9887	1285	1372
	4	29	75	65	59	22736	9996	1299	1370
	5	30	75	65	59	22902	10162	1321	1593
	6	31	75	65	59	23028	10288	1337	1593
	7	32	75	65	59	23754	11014	1432	1639
	8	33	75	64	55	23892	11152	1450	1639
	9	34	75	65	59	24030	11290	1468	-
	10	35	75	66	63	24153	11413	1484	1646
	11	36	75	66	63	24172	11432	1486	-
	12	37	75	68	70	24170	11430	1486	1644
	13	38	75	65	59	24222	11482	1493	1656
	14	39	75	68	70	24247	11507	1496	-
	15	40	75	65	59	24360	11620	1511	1666

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June	16	41	75	68	70	24430	11690	1520	-
	17	42	75	66	63	24481	11741	1526	1678
	18	43	75	66	63	24528	11788	1532	-
	19	44	75	65	59	24623	11883	1545	1691
	20	45	75	64	55	24741	12001	1560	-
	21	46	75	65	59	24825	12085	1571	1698
	22	47	75	68	70	24971	12231	1590	-
	23	48	75	64	55	00085	12345	1605	-
	24	49	75	64	55	00173	12433	1616	-
	25	50	75	64	55	00295	12555	1632	1754
	26	51	75	63	51	00400	12660	1646	-
	27	52	75	67	66	00326	12586	1636	-
	28	53	75	67	66	00240	12500	1625	-
	29	54	75	65	59	00189	12449	1618	1732
	30	55	75	67	66	00198	12458	1620	1715
July	1	56	75	65	59	00363	12623	1641	-
	2	57	75	61	44	00431	12691	1650	1715
	3	58	75	62	48	00444	12704	1652	-
	4	59	-	-	-	-	-	-	-
	5	60	75	67	66	00710	12970	1686	θ
	6	61	75	65	59	00873	13133	1707	1730
	7	62	75	63	51	00954	13214	1718	-
	8	63	75	64	55	01008	13268	1725	-
	9	64	-	-	-	-	-	-	-
	10	65	75	65	59	01080	13340	1734	-
	11	66	75	65	59	01200	13460	1750	-
	12	67	75	65	59	01300	13560	1763	-
	13	68	77	65	52	01380	13640	1773	-
	14	69	77	67	60	01455	13715	1783	1759
	15	70	75	75	100	01243	13503	1755	-
	16	71	75	72	86	01141	13401	1742	-
	17	72	76	67	63	01264	13524	1758	-
	18	73	76	67	63	01362	13622	1771	-
	19	74	77	67	60	01430	13690	1780	1766
	20	75	77	66	56	01550	13810	1795	-
	21	76	76	67	63	01590	13850	1800	-
	22	77	76	66	59	01640	13900	1807	-
	23	78	77	68	63	01705	13965	1815	-
	24	79	78	68	60	01742	14002	1820	-
	25	80	77	66	56	01870	14130	1837	-
	26	81	77	65	52	01895	14155	1840	1784
	27	82	76	65	55	01970	14230	1850	1784
	28	83	75	65	59	02050	14310	1860	-
	29	84	75	65	59	02073	14333	1863	-
	30	85	75	65	59	02068	14328	1863	-
	31	86	75	67	66	02050	14310	1860	-
Aug.	1	87	-	-	-	-	-	-	-
	2	88	75	63	51	02072	14332	1863	-
	3	89	75	65	59	02104	14364	1867	-
	4	90	75	65	59	02131	14391	1871	1825
	5	91	75	64	55	02290	14550	1891	-

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
Aug.	6	92	75	65	59	02323	14583	1869	2009
	7	93	75	65	59	02370	14630	1902	2009
	8	94	76	65	55	02410	14670	1907	-
	9	95	75	66	63	02435	14695	1910	-
	10	96	75	65	59	02435	14695	1910	-
	11	97	75	64	55	02495	14755	1918	-
	12	98	75	65	59	02564	14824	1927	-
	13	99	75	64	55	02590	14850	1931	-
	14	100	75	64	55	-	-	-	-
	15	101	75	64	55	02600	14860	1932	2068
	16	102	74	64	58	02570	14830	1928	-
	17	103	74	64	58	02572	14832	1928	-
	18	104	73	65	65	02562	14822	1927	2070
	19	105	73	64	61	02581	14841	1929	-
	20	106	73	64	61	02581	14841	1929	-
	21	107	72	64	65	02571	14831	1928	-
	22	108	-	-	-	-	-	-	-
	23	109	71	64	69	02531	14791	1922	2068
	24	110	71	64	69	02501	14761	1919	2063
	25	111	71	63	64	02511	14771	1920	-
	26	112	71	63	64	02518	14778	1921	-
	27	113	71	63	64	02531	14791	1923	-
	28	114	74	63	54	02689	14949	1943	2068
	29	115	74	63	54	02733	14993	1949	-
	30	116	-	-	-	-	-	-	-
	31	117	74	64	58	18074	5334	693	-
Sept.	1	118	74	63	54	18017	5277	686	-
	2	119	74	64	58	17961	5221	679	-
	3	120	74	64	58	17918	5178	673	-
	4	121	74	64	58	17880	5140	668	-
	5	122	-	-	-	-	-	-	-
	6	123	-	-	-	-	-	-	-
	7	124	74	62	51	17850	5110	663	-
	8	125	-	-	-	-	-	-	-
	9	126	74	64	58	17758	5018	652	-
	10	127	74	63	54	17734	4994	649	-
	11	128	74	63	54	17719	4979	647	-
	12	129	-	-	-	-	-	-	-
	13	130	74	65	62	17668	4928	641	-

Sample No. 4-L-29

Date Poured April 29/59

Age at loading 29 days

Age at unloading

Compressive strength 4023 psi

Stress applied 1805 psi

Initial deformation 1126×10^{-6} in/in

Initial recovery 1010×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
						01729			
May	28	Initial	75	64	55	10392	8663	1126	1281
	29	1	75	64	55	12444	2052	267	208
	30	2	75	64	55	12802	2410	313	-
	31	3	-	-	-	-	-	-	-
June	1	4	75	65	59	13289	2897	377	326
	2	5	75	65	59	13802	3410	443	365
	3	6	75	65	59	14021	3629	472	372
	4	7	75	65	59	14197	3805	495	390
	5	8	75	65	59	14432	4040	525	497
	6	9	75	65	59	14607	4215	548	517
	7	10	75	65	59	15135	4743	617	559
	8	11	75	64	55	15279	4887	635	571
	9	12	75	65	59	15431	5039	655	-
	10	13	75	66	63	15559	5167	672	600
	11	14	75	66	63	15586	5194	675	-
	12	15	75	68	70	15608	5216	678	595
	13	16	75	65	59	15667	5275	686	613
	14	17	75	68	70	15738	5346	695	-
	15	18	75	65	59	15835	5443	708	644
	16	19	75	68	70	15901	5509	716	-
	17	20	75	66	63	15953	5561	723	657
	18	21	75	66	63	16015	5623	731	-
	19	22	75	65	59	16104	5712	743	676
	20	23	75	64	55	16230	5838	759	-
	21	24	75	65	59	16720	6328	823	696
	22	25	75	68	70	16850	6458	840	-
	23	26	75	64	55	16961	6569	854	-
	24	27	75	64	55	17055	6663	866	-
	25	28	75	64	55	17161	6769	880	735
	26	29	75	63	51	17273	6881	895	-
	27	30	75	67	66	17220	6828	888	-
	28	31	75	67	66	17174	6782	882	-
	29	32	75	65	59	17143	6751	878	730
	30	33	75	67	66	17159	6767	880	728
July	1	34	75	65	59	17321	6929	901	-
	2	35	75	61	44	17390	6998	910	736
	3	36	75	62	48	17400	7008	911	-
	4	37	-	-	-	-	-	-	-
	5	38	75	67	66	17655	7263	944	-
	6	39	75	65	59	17815	7423	965	737
	7	40	75	63	51	17905	7513	977	-

Date	Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
July 8	41	7564		55	17943	7551	982	-
9	42	-	-	-	-	-	-	-
10	43	75	65	59	18025	7633	992	-
11	44	75	65	59	18119	7727	1005	-
12	45	75	65	59	18210	7818	1016	-
13	46	77	65	52	18301	7909	1028	-
14	47	77	67	60	-	-	-	-
15	48	75	75	100	18212	7820	1017	784
16	49	75	72	86	18155	7763	1009	-
17	50	76	67	63	18260	7868	1023	-
18	51	76	67	63	18338	7946	1033	-
19	52	77	67	60	18380	7988	1038	796
20	53	77	66	56	18491	8099	1053	-
21	54	76	67	63	18522	8130	1057	-
22	55	76	66	59	18588	8196	1065	-
23	56	77	68	63	18641	8249	1072	-
24	57	78	68	60	18682	8290	1078	-
25	58	77	66	56	18800	8408	1093	-
26	59	77	65	52	18840	8448	1098	826
27	60	76	65	55	18883	8491	1104	845
28	61	75	65	59	18972	8580	1115	-
29	62	75	65	59	18983	8591	1117	-
30	63	75	65	59	18975	8583	1116	-
31	64	75	67	66	18961	8569	1114	-
Aug. 1	65	-	-	-	-	-	-	-
2	66	75	63	51	18968	8576	1115	-
3	67	75	65	59	19000	8608	1119	-
4	68	75	65	59	19041	8649	1124	858
5	69	75	64	55	19163	8771	1140	-
6	70	75	65	59	19196	8804	1145	1002
7	71	75	65	59	19251	8859	1152	1002
8	72	76	65	55	19282	8890	1156	-
9	73	75	66	63	19313	8921	1160	-
10	74	75	65	59	19315	8923	1160	-
11	75	75	64	55	19383	8991	1169	-
12	76	75	65	59	19431	9039	1175	-
13	77	75	64	55	19460	9068	1179	-
14	78	75	64	55	-	-	-	-
15	79	75	64	55	19470	9078	1180	1054
16	80	74	64	58	19468	9076	1180	-
17	81	74	64	58	19477	9085	1181	-
18	82	73	65	65	19465	9073	1179	1054
19	83	73	64	61	19390	9088	1183	-
20	84	73	64	61	19491	9099	1183	-
21	85	72	64	65	19479	9087	1181	-
22	86	-	-	-	-	-	-	-
23	87	71	64	69	19453	9061	1178	1056
24	88	71	64	69	19432	9040	1175	1054
25	89	71	63	64	19443	9051	1177	-
26	90	71	63	64	19449	9057	1177	-

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
Aug.	27	91	71	63	64	19460	9068	1179	-
	28	92	74	63	54	19595	9203	1197	1056
	29	93	74	63	54	19635	9243	1202	-
	30	94	-	-	-	-	-	-	-
	31	95	75	64	58	10998	0606	79	-
Sept.	1	96	74	63	54	10970	578	75	-
	2	97	74	64	58	10923	531	69	-
	3	98	74	64	58	10896	504	66	-
	4	99	74	64	58	10878	476	62	-
	5	100	-	-	-	-	-	-	-
	6	101	-	-	-	-	-	-	-
	7	102	74	62	51	10866	474	62	-
	8	103	-	-	-	-	-	-	-
	9	104	74	64	58	10799	407	53	-
	10	105	74	63	54	10779	387	50	-
	11	106	74	63	54	10762	370	48	-
	12	107	-	-	-	-	-	-	-
	13	1o8	74	65	62	10728	336	44	-

Sample No. 5-L3

Date Poured April 29/59

Age at loading 3 days

Age at unloading

Compressive strength 3585 psi

Stress applied 1663 psi

Initial deformation 1110×10^{-6} in/in

Initial recovery 966×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
						00324			
May	2	Initial	75	64	55	08866	8542	.001110	706
	3	1	74	68	74	11428	2562	333	311
	4	2	74	67	70	11485	2619	340	439
	5	3	74	63	54	11990	3124	406	527
	6	4	75	66	63	12460	3594	467	566
	7	5	75	66	63	12915	4049	526	637
	8	6	75	64	55	13208	4342	564	664
	9	7	74	66	66	13490	4624	601	718
	10	8	74	66	66	13750	4884	635	750
	11	9	74	66	66	14082	5216	678	-
	12	10	75	65	59	14330	5464	710	799
	13	11	75	62	48	14488	5622	731	-
	14	12	74	63	51	15342	6476	842	907
	15	13	-	-	-	15535	6669	867	-
	16	14	75	64	55	15706	6840	889	-
	17	15	75	64	55	15847	6981	908	-
	18	16	75	64	55	16082	7216	938	1017
	19	17	75	65	59	16069	7203	936	1014
	20	18	75	65	59	16218	7352	956	1014
	21	19	75	65	59	16491	7625	991	1031
	22	20	-	-	-	-	-	-	-
	23	21	75	63	51	16770	7904	1028	1110
	24	22	75	64	55	16879	8013	1042	1122
	25	23	75	62	48	17089	8223	1069	1132
	26	24	75	62	48	18359	9493	1234	1286
	27	25	75	67	66	18420	9554	1242	1294
	28	26	75	64	55	18635	9769	1270	1323
	29	27	75	64	55	18662	9796	1273	1300
	30	28	75	64	55	18645	9779	1271	-
	31	29	-	-	-	-	-	-	-
June	1	30	75	65	59	18792	9926	1290	1350
	2	31	75	65	59	18917	10051	1307	1370
	3	32	75	65	59	19020	10154	1320	1377
	4	33	75	65	59	19106	10340	1331	1382
	5	34	75	65	59	19242	10376	1349	1414
	6	35	75	65	59	19348	10482	1363	1428
	7	36	75	65	59	19477	10611	1379	1448
	8	37	75	64	55	19546	10680	1388	1453
	9	38	75	65	59	19609	10743	1397	-
	10	39	75	66	63	19670	10804	1405	1458
	11	40	75	66	63	19679	10813	1406	-
	12	41	75	68	70	19639	10773	1400	1460

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June	13	42	75	65	59	16975	10809	1405	1468
	14	43	75	68	70	19680	10814	1406	-
	15	44	75	65	59	19761	10895	1416	1485
	16	45	75	68	70	19798	10932	1421	-
	17	46	75	66	63	19831	10965	1425	1485
	18	47	75	66	63	19859	10993	1429	-
	19	48	75	65	59	19935	11069	1439	1499
	20	49	75	64	55	20043	11177	1453	-
	21	50	75	65	59	20330	11464	1490	1519
	22	51	75	68	70	20525	11559	1503	-
	23	52	75	64	59	20510	11644	1514	-
	24	53	75	64	59	20573	11707	1522	-
	25	54	75	64	59	20660	11794	1533	1553
	26	55	75	63	51	20726	11860	1542	-
	27	56	75	67	66	20655	11789	1533	-
	28	57	75	67	66	20581	11715	1523	-
	29	58	75	65	59	20528	11662	1516	1539
	30	59	75	67	66	20534	11668	1517	1536
July	1	60	75	65	59	20665	11799	1534	-
	2	61	75	61	44	20703	11837	1539	1546
	3	62	75	62	48	20700	11834	1538	-
	4	63	-	-	-	-	-	-	-
	5	64	75	67	66	20910	12044	1566	-
	6	65	75	65	59	21061	12195	1585	1573
	7	66	75	63	51	21113	12247	1592	-
	8	67	75	64	55	21140	12274	1596	-
	9	68	-	-	-	-	-	-	-
	10	69	75	65	59	21173	12307	1600	-
	11	70	75	65	59	21256	12390	1611	-
	12	71	75	65	59	21330	12464	1620	-
	13	72	77	65	52	21385	12519	1628	-
	14	73	77	67	60	21440	12574	1635	1612
	15	74	75	75	100	21265	12399	1612	-
	16	75	75	72	86	21190	12324	1602	-
	17	76	76	67	63	21282	12416	1614	-
	18	77	76	67	63	21338	12472	1621	-
	19	78	77	67	60	21380	12514	1627	1617
	20	79	77	66	56	21454	12588	1636	-
	21	80	76	67	63	21483	12617	1640	-
	22	81	76	66	59	21530	12663	1646	-
	23	82	77	68	63	21568	12702	1651	-
	24	83	78	68	60	21594	12728	1655	-
	25	84	77	66	56	21699	12833	1668	-
	26	85	77	65	52	21723	12857	1671	1649
	27	86	77	65	55	21780	12914	1679	1656
	28	87	75	65	59	21880	13014	1692	-
	29	88	75	65	59	21880	13014	1692	-
	30	89	75	65	59	21865	12999	1690	-
	31	90	75	67	66	21835	12969	1686	-
Aug.	1	91	-	-	-	-	-	-	-
	2	92	75	63	51	21822	12956	1684	-

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
Aug.	3	93	75	65	59	21841	12975	1687	-
	4	94	75	65	59	21860	12994	1689	1666
	5	95	75	64	55	22000	13134	1707	-
	6	96	75	65	59	22020	13154	1710	1691
	7	97	75	65	59	22068	13204	1717	1693
	8	98	76	65	55	22114	13248	1722	-
	9	99	75	66	63	22124	13258	1724	-
	10	100	75	65	59	22129	13263	1724	-
	11	101	75	64	55	22172	13306	1730	-
	12	102	75	65	59	22230	13364	1737	-
	13	103	75	64	55	22242	13376	1739	-
	14	104	75	64	55	-	-	-	-
	15	105	75	64	55	22249	13383	1740	1735
	16	106	74	64	58	22252	13386	1740	-
	17	107	74	64	58	22252	13386	1740	-
	18	108	73	65	65	22238	13372	1738	1735
	19	109	73	64	61	22254	13388	1740	-
	20	110	73	64	61	22252	13386	1740	-
	21	111	72	64	65	22235	13369	1738	-
	22	112	-	-	-	-	-	-	-
	23	113	71	64	69	22200	13334	1733	1740
	24	114	71	64	69	22175	13309	1730	1742
	25	115	71	63	64	22182	13316	1731	-
	26	116	71	63	64	22187	13321	1732	-
	27	117	71	63	64	22194	13328	1733	-
	28	118	74	63	54	22312	13446	1748	1744
	29	119	74	63	54	22339	13463	1750	-
	30	120	-	-	-	-	-	-	-
	31	121	74	64	58	14128	5262	684	-
Sept.	1	122	74	63	54	14091	5225	679	-
	2	123	74	64	58	14058	5192	675	-
	3	124	74	64	58	14011	5145	669	-
	4	125	74	64	58	13982	5116	665	-
	5	126	-	-	-	-	-	-	-
	6	127	-	-	-	-	-	-	-
	7	128	74	62	51	13975	5109	664	-
	8	129	-	-	-	-	-	-	-
	9	130	74	64	58	13899	5033	654	-
	10	131	74	63	54	13873	5007	651	-
	11	132	74	63	54	13860	4994	649	-
	12	133	-	-	-	-	-	-	-
	13	134	74	65	62	13824	4958	645	-

Creep of Concrete

Sample No. 5-L-7

Date Poured April 29/59

Age at loading 7 days

Age at unloading

Compressive strength 4728 psi

Stress applied 2159 psi

Initial deformation 1288×10^{-6} in/in

Initial recovery 1327×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
						01971			
May	6	Initial	75	66	63	11879	9908	1288	1460
	7	1	75	66	63	14103	2224	289	328
	8	2	75	64	55	14768	2889	376	392
	9	3	74	66	66	15269	3390	441	468
	10	4	74	66	66	15662	3783	492	512
	11	5	74	66	66	16142	4263	554	-
	12	6	75	65	59	16482	4603	598	551
	13	7	75	62	48	16794	4915	639	568
	14	8	75	63	51	17047	5168	672	583
	15	9	-	-	-	17261	5382	700	-
	16	10	75	64	55	17455	5576	725	-
	17	11	75	64	55	17620	5741	746	-
	18	12	75	64	55	17883	6004	781	718
	19	13	75	65	59	17894	6015	782	735
	20	14	75	65	59	18079	6200	806	723
	21	15	75	65	59	18400	6521	848	742
	22	16	-	-	-	-	-	-	-
	23	17	75	63	51	19511	7632	992	975
	24	18	75	64	55	19702	7823	1017	982
	25	19	75	62	48	19941	8062	1048	997
	26	20	75	62	48	20129	8250	1073	1034
	27	21	75	67	66	20140	8261	1074	1046
	28	22	75	64	55	20318	8439	1097	1076
	29	23	75	64	55	20347	8468	1101	1093
	30	24	75	64	55	20320	8441	1097	-
	31	25	-	-	-	-	-	-	-
June	1	26	75	65	59	20480	8601	1118	1095
	2	27	75	65	59	20640	8761	1139	1095
	3	28	75	65	59	20714	8835	1149	1098
	4	29	75	65	59	20800	8921	1160	1115
	5	30	75	65	59	20959	9080	1180	1210
	6	31	75	65	59	21039	9160	1191	1218
	7	32	75	65	59	21666	9787	1272	1274
	8	33	75	64	55	21768	9889	1286	1294
	9	34	75	65	59	21842	9963	1295	-
	10	35	75	66	63	21929	10050	1307	1303
	11	36	75	66	63	21929	10050	1307	-
	12	37	75	68	70	21917	10038	1305	1296
	13	38	75	65	59	21951	10072	1309	1303
	14	39	75	68	70	21959	10080	1310	-
	15	40	75	65	59	22045	10166	1322	1325

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June	16	41	75	68	70	22097	10218	1328	-
	17	42	75	66	63	22138	10259	1334	1338
	18	43	75	66	63	22169	10290	1338	-
	19	44	75	64	59	22265	10386	1350	1360
	20	45	75	64	55	22362	10483	1363	-
	21	46	75	64	59	22465	10586	1376	1377
	22	47	75	68	70	22569	10690	1390	-
	23	48	75	64	55	22655	10776	1401	-
	24	49	75	64	55	22730	10851	1411	-
	25	50	75	64	55	22815	10936	1422	1409
	26	51	75	63	51	22897	11018	1432	-
	27	52	75	67	66	22820	10941	1422	-
	28	53	75	67	66	22758	10879	1414	-
	29	54	75	65	59	22705	10826	1407	1401
	30	55	75	67	66	22710	10831	1408	1379
July	1	56	75	65	59	22840	10961	1425	-
	2	57	75	61	44	22888	11009	1431	1404
	3	58	75	62	48	22891	11012	1432	-
	4	59	-	-	-	-	-	-	-
	5	60	75	67	66	23110	11231	1460	-
	6	61	75	65	59	23260	11381	1480	1426
	7	62	75	63	51	23315	11436	1487	-
	8	63	75	64	55	23354	11475	1492	-
	9	64	-	-	-	-	-	-	-
	10	65	75	65	59	23426	11547	1501	-
	11	66	75	65	59	23509	11630	1512	-
	12	67	75	65	59	23578	11699	1521	-
	13	68	77	65	52	23645	11766	1530	-
	14	69	77	67	60	23708	11829	1538	1470
	15	70	75	75	100	23512	11642	1513	-
	16	71	75	72	86	23445	11566	1504	-
	17	72	76	67	63	23540	11661	1516	-
	18	73	76	67	63	23600	11721	1534	-
	19	74	77	67	60	23645	11766	1530	1477
	20	75	77	66	56	23720	11841	1539	-
	21	76	76	67	63	23758	11879	1544	-
	22	77	76	66	59	23800	11921	1550	-
	23	78	77	68	63	23857	11978	1557	-
	24	79	78	68	60	23884	12005	1561	-
	25	80	77	66	56	24010	12131	1577	-
	26	81	77	65	52	24030	12151	1580	1504
	27	82	76	65	55	24072	12193	1585	1521
	28	83	75	65	59	24103	12224	1589	-
	29	84	75	65	59	24104	12225	1589	-
	30	85	75	65	59	24104	12225	1589	-
	31	86	75	67	66	24105	12226	1589	-
Aug.	1	87	-	-	-	-	-	-	-
	2	88	75	63	51	24110	12231	1590	-
	3	89	75	65	59	24110	12231	1590	-
	4	90	75	65	59*	24110	12231	1590	1536

* dial checked and found to be stuck

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
Aug.	5	91	75	64	55	24300	12421	1615	-
	6	92	75	65	59	243221	12442	1617	1595
	7	93	75	65	59	24369	12490	1624	1597
	8	94	76	65	55	24436	12557	1632	-
	9	95	75	66	63	24451	12572	1634	-
	10	96	75	65	59	24453	12574	1635	-
	11	97	75	64	55	24503	12624	1641	-
	12	98	75	65	59	24557	12678	1648	θ
	13	99	75	64	55	24574	12694	1650	-
	14	100	75	64	55	-	-	-	-
	15	101	75	64	55	24577	12698	1651	1656
	16	102	74	64	58	24577	12698	1651	-
	17	103	74	64	58	24578	12699	1651	-
	18	104	74	65	65	24566	12687	1649	1656
	19	105	73	64	61	24580	12701	1651	-
	20	106	73	64	61	24580	12701	1651	-
	21	107	72	64	65	24569	12690	1650	-
	22	108	-	-	-	-	-	-	-
	23	109	71	64	69	24537	12658	1646	1659
	24	110	71	63	69	24515	12636	1643	1659
	25	111	71	63	64	24521	12642	1643	-
	26	112	71	63	64	24525	12646	1644	-
	27	113	71	63	64	24538	12659	1646	-
	28	114	74	63	54	24686	12807	1665	1666
	29	115	74	63	54	24708	12829	1668	-
	30	116	-	-	-	-	-	-	-
	31	117	74	64	58	14643	2764	359	-
Sept.	1	118	75	63	54	14589	2710	352	-
	2	119	74	64	58	14550	2671	347	-
	3	120	74	64	58	14511	2632	342	-
	4	121	74	64	58	14480	2601	338	-
	5	122	-	-	-	-	-	-	-
	6	123	-	-	-	-	-	-	-
	7	124	74	62	51	14471	2592	337	-
	8	125	-	-	-	-	-	-	-
	9	126	74	64	58	14400	2521	328	-
	10	127	74	63	54	14376	2497	325	-
	11	128	74	63	54	14360	2481	323	-
	12	129	-	-	-	-	-	-	-
	13	130	74	65	62	14313	2434	316	-

Sample No. 5-L-29

Date Poured April 29/59

Age at loading 29 days

Age at unloading

Compressive strength 5343 psi

Stress applied 2389 psi

Initial deformation 1120×10^{-6} in/in

Initial recovery 1000×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
						00548			
May	28	Initial	75	64	55	09160	8612	1120	1103
	29	1	75	64	55	10280	1120	146	147
	30	2	75	64	55	10648	1488	193	-
	31	3	-	-	-	-	-	-	-
June	1	4	75	65	59	11195	2035	265	-
	2	5	75	65	59	11460	2300	299	-
	3	6	75	65	59	11673	2513	327	-
	4	7	75	65	59	11881	2721	354	409
	5	8	75	65	59	12086	2926	380	625
	6	9	75	65	59	12247	3087	401	637
	7	10	75	65	59	12618	3458	450	649
	8	11	75	64	55	12745	3585	466	625
	9	12	75	65	59	12885	3725	484	-
	10	13	75	66	63	12999	3839	499	627
	11	14	75	66	63	13026	3866	503	-
	12	15	75	68	70	13030	3870	503	620
	13	16	75	65	59	13108	3948	513	632
	14	17	75	68	70	13141	3981	518	-
	15	18	75	65	59	13275	4115	535	649
	16	19	75	68	70	13350	4190	545	-
	17	20	75	66	63	13411	4251	553	657
	18	21	75	66	63	13465	4305	560	-
	19	22	75	65	59	13568	4408	573	671
	20	23	75	64	55	13680	4520	588	-
	21	24	75	65	59	13733	4573	594	684
	22	25	75	68	70	13900	4740	616	-
	23	26	75	64	55	14018	4858	632	-
	24	27	75	64	55	14108	4948	643	-
	25	28	75	64	55	14206	5046	656	691
	26	29	75	63	51	14313	5153	670	-
	27	30	75	67	66	14243	5083	661	-
	28	31	75	67	66	15187	5027	654	-
	29	32	75	65	59	14142	4982	648	681
	30	33	75	67	66	14163	5003	650	691
July	1	34	75	65	59	14329	5169	672	-
	2	35	75	61	44	14391	5231	680	698
	3	36	75	62	48	14400	5240	681	-
	4	37	-	-	-	-	-	-	-

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
July	5	38	75	67	66	14656	5496	714	-
	6	39	75	65	59	14821	5661	736	720
	7	40	75	63	51	14893	5733	745	-
	8	41	75	64	55	14939	5779	751	-
	9	42	-	-	-	-	-	-	-
	10	43	75	65	59	15005	5845	760	-
	11	44	75	65	59	-	-	-	-
	12	45	75	65	59	15193	6033	784	-
	13	46	77	65	52	15273	6113	795	-
	14	47	77	67	60	15340	6180	803	755
	15	48	75	75	100	15143	5983	778	-
	16	49	75	72	86	15071	5911	768	-
	17	50	76	67	63	15197	6037	785	-
	18	51	76	67	63	15270	6110	794	-
	19	52	77	67	60	15328	6168	802	769
	20	53	77	66	56	15427	6267	815	-
	21	54	76	67	63	15470	6310	820	-
	22	55	76	66	59	15523	6363	827	-
	23	56	77	68	63	15588	6428	836	-
	29	57	78	68	60	15615	6455	839	-
	25	58	77	66	56	15745	6585	856	-
	26	59	77	65	52	15758	6598	858	796
	27	60	76	65	55	15830	6670	867	801
	28	61	75	65	59	15912	6752	878	-
	29	62	75	65	59	15922	6762	879	-
	30	63	75	65	59	15910	6750	878	-
	31	64	75	67	66	15899	6739	876	-
Aug.	1	65	-	-	-	-	-	-	-
	2	66	75	63	51	15905	6745	877	-
	3	67	75	65	59	15930	6770	880	-
	4	68	75	65	59	15950	6790	883	818
	5	69	75	64	55	16101	6941	902	-
	6	70	75	65	59	16131	6971	906	933
	7	71	75	65	59	16180	7020	913	931
	8	72	76	65	55	16204	7044	916	-
	9	73	75	66	63	16220	7060	918	-
	10	74	75	65	59	16231	7071	919	-
	11	75	75	64	55	16297	7137	928	-
	12	76	75	65	59	16360	7200	936	-
	13	77	75	64	55	16380	7220	939	-
	14	78	75	64	55	-	-	-	-
	15	79	75	64	55	16386	7226	939	960
	16	80	74	64	58	16382	7222	939	-
	17	81	74	64	58	16390	7230	940	-
	18	82	73	65	65	16378	7218	938	960
	19	83	73	64	61	16401	7241	941	-
	20	84	73	64	61	16401	7241	941	-
	21	85	72	64	65	16390	7230	940	-
	22	86	-	-	-	-	-	-	-
	23	87	71	64	69	16363	7203	936	956

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
Aug.	24	88	71	64	69	16348	7188	934	951
	25	89	71	63	64	16359	7199	936	-
	26	90	71	63	64	16363	7203	936	-
	27	91	71	63	64	16370	7210	937	-
	28	92	74	63	54	16515	7355	956	958
	29	93	74	63	54	16545	7385	960	-
	30	94	-	-	-	-	-	-	-
	31	95	74	64	58*	08122	+ 1038	+ 135	-
Sept.	1	96	74	63	54	08075	+ 1085	+ 141	-
	2	97	74	64	58	08031	+ 1129	+ 147	-
	3	98	75	64	58	08000	+ 1160	+ 151	-
	4	99	74	64	58	07968	+ 1192	+ 155	-
	5	100	-	-	-	-	-	-	-
	6	101	-	-	-	-	-	-	-
	7	102	74	62	51	07956	+ 1204	+ 157	-
	8	103	-	-	-	-	-	-	-
	9	104	74	64	58	07892	+ 1268	+ 165	-
	10	105	74	63	54	07865	+ 1295	+ 168	-
	11	106	74	63	54	07853	+ 1307	+ 170	-
	12	107	-	-	-	-	-	-	-
	13	108	74	65	62	07818	+ 1342	+ 174	-

* Indicates recovery greater than creep.

Creep of Concrete

Sample No. 3-R-4

Date Poured Feb. 23/59

Age at loading 4 days

Age at unloading

Compressive strength 1816 psi

Stress applied 874 psi

Initial deformation 2026×10^{-6} in/in

Initial recovery 436×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
Feb.	27	Initial	75	66	63	16802	15587	2026	-
	28	1	75	65	59	18518	1716	223	287
March	1	2	75	64	62	19039	2237	291	274
	2	3	76	69	70	19472	2670	247	314
	3	4	75	66	63	19785	2983	388	404
	4	5	75	66	63	20052	3250	423	463
	5	6	76	66	59	20290	3488	453	431
	6	7	75	65	59	20435	3633	472	443
	7	8	75	65	59	20880	4078	530	-
	8	9	75	65	59	21119	4317	561	571
	9	10	75	64	55	21311	4509	586	608
	10	11	75	65	59	21480	4678	608	652
	11	12	75	65	59	21613	4811	625	688
	12	13	75	64	55	21764	4962	645	696
	13	14	75	64	55	21889	5087	661	696
	14	15	75	64	55	21995	5193	675	715
	15	16	75	65	59	22109	5307	690	742
	16	17	75	64	55	22250	5448	708	750
	17	18	75	64	55	22360	5558	723	771
	18	19	75	64	55	22451	5649	734	792
	19	20	75	64	55	22521	5719	743	784
	20	21	75	65	59	22633	5831	758	804
	21	22	75	65	59	22732	5930	771	809
	22	23	75	63	51	22838	6036	785	831
	23	24	75	63	51	22972	6170	802	-
	24	25	75	63	51	23049	6247	812	845
	25	26	75	63	51	23148	6346	825	882
	26	27	75	62	48	23239	6337	837	887
	27	28	75	62	48	23315	6513	847	909
	28	29	75	63	51	-	-	-	-
	29	30	75	65	59	-	-	-	-
	30	31	75	65	59	23509	6707	872	921
	31	32	75	64	55	23561	6759	879	931
April	1	33	75	63	51	23669	6867	893	936
	2	34	75	62	48	23742	6940	902	948
	3	35	75	63	51	23853	7051	917	953
	4	36	75	62	48	23936	7134	927	968
	5	37	75	62	48	23012	7210	937	985
	6	38	75	61	44	24104	7302	949	1005
	7	39	75	62	48	24165	7363	957	-
	8	40	75	66	63	24493	7691	1000	1014
	9	41	75	65	59	24518	7716	1003	1036
	10	42	75	63	51	24636	7834	1018	1031

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
April	11	43	75	62	48	23800	7998	1040	-
	12	44	75	62	48	24868	8066	1049	1080
	13	45	75	62	48	24984	8182	1064	1068
	14	46	75	66	63	00082	8280	1076	-
	15	47	75	63	51	00152	8350	1086	1078
	16	48	75	63	51	00203	8401	1092	1112
	17	49	75	63	51	00289	8487	1103	1127
	18	50	75	63	51	00362	8560	1113	1125
	19	51	75	63	51	00422	8620	1120	1137
	20	52	75	63	51	00462	8660	1126	1132
	21	53	75	64	55	00489	8696	1130	1142
	22	54	75	65	59	00528	8726	1134	1143
	23	55	75	65	59	00552	8750	1138	1149
	24	56	75	65	63	00587	8785	1142	1149
	25	57	75	65	59	00632	8830	1148	1147
	26	58	75	65	59	00703	8901	1157	1176
	27	59	74	64	58	00754	8952	1164	1178
	28	60	75	65	59	00799	8997	1170	1183
	29	61	75	65	59	00827	9025	1173	1183
	30	62	-	-	-	-	-	-	-
May	1	63	74	65	62	00897	9070	1179	1186
	2	64	75	64	55	00928	9126	1186	-
	3	65	74	68	71 *	00881	9079	1180	1203
	4	66	74	67	70	00869	9067	1179	1203
	5	67	74	63	54	00975	9173	1192	-
	6	68	75	66	63	01045	9243	1202	1215
	7	69	75	66	63	01434	9632	1252	1242
	8	70	75	64	55	01482	9680	1258	1254
	9	71	74	66	66	01536	9734	1265	1269
	10	72	74	66	66	01577	9775	1271	1274
	11	73	74	66	66	01639	9837	1279	-
	12	74	75	65	59	01702	9900	1287	1279
	13	75	75	62	48	01750	9948	1293	1279
	14	76	75	63	51	01789	9987	1298	1279
	15	77	-	-	-	01819	10017	1302	-
	16	78	75	64	55	01850	10048	1306	-
	17	79	75	64	55	01855	10053	1307	-
	18	80	75	64	55	01912	10110	1314	1299
	19	81	75	65	59	01860	10058	1308	1311
	20	82	75	65	59	01885	10083	1311	1308
	21	83	75	65	59	01943	10141	1318	1316
	22	84	-	-	-	-	-	-	-
	23	85	75	63	51	02073	10271	1335	1328
	24	86	75	64	55	02129	10327	1343	1330
	25	87	75	62	48	02205	10403	1352	1328
	26	88	75	62	48	02233	10431	1356	-
	27	89	75	67	66	02890	11088	1441	1401
	28	90	75	64	55	03000	11198	1456	1409
	29	91	75	64	55	02997	11195	1455	1414
	30	92	75	64	55	02975	11173	1452	-
	31	93	-	-	-	-	-	-	-

* Light Weight Started

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June	1	94	75	65	59	03040	11238	1461	1419
	2	95	75	65	59	03097	11295	1468	1419
	3	96	75	65	59	03138	11336	1474	1423
	4	97	75	65	59	03173	11371	1478	1426
	5	97	75	65	59	03270	11468	1491	1433
	6	99	75	65	59	03282	11480	1492	1438
	7	100	75	65	59	03351	11549	1501	1482
	8	101	75	64	55	03399	11597	1508	1487
	9	102	75	65	59	03423	11621	1511	-
	10	103	75	66	63	03451	11649	1415	1487
	11	104	75	66	63	03441	11639	1513	-
	12	105	75	68	70	03411	11609	1509	1485
	13	106	75	65	59	03439	11637	1513	1480
	14	107	75	68	70	03615	11813	1536	-
	15	108	75	65	59	03667	11865	1542	1495
	16	109	75	68	70	03682	11880	1544	-
	17	110	75	66	63	03703	11901	1547	1519
	18	111	75	66	63	03708	11906	1548	-
	19	112	75	65	59	03745	11943	1553	1524
	20	113	75	64	55	03790	11988	1558	-
	21	114	75	65	59	03760	11958	1555	1534
	22	111	75	68	70	03815	12013	1562	-
	23	116	75	64	55	03870	12068	1569	-
	24	117	75	64	55	03910	12108	1574	-
	25	118	75	64	55	03962	12160	1581	1536
	26	119	75	63	51	04002	12200	1586	-
	27	120	75	67	66	03935	12133	1577	-
	28	121	75	67	66	03899	12097	1573	-
	29	122	75	65	59	03864	12062	1568	1531
	30	123	75	67	66	03872	12070	1569	1529
July	1	124	75	65	59	03962	12160	1581	-
	2	125	75	61	44	00158	8356	1086	-
	3	126	75	62	48	00070	8268	1075	-
	4	127	-	-	-	-	-	-	-
	5	128	75	67	66	00076	8274	1076	-
	6	129	75	65	59	00100	8298	1079	-
	7	130	75	63	51	00108	8306	1080	-
	8	131	75	64	55	00094	8292	1078	-
	9	132	-	-	-	-	-	-	-
	10	133	75	65	59	00049	8247	1072	-
	11	134	75	65	59	00051	8249	1072	-
	12	135	75	65	59	00040	8238	1071	-
	13	136	77	65	52	00045	8243	1072	-
	14	137	77	67	60	00050	8348	1072	-
	15	138	75	75	100	24809	8007	1041	-
	16	139	75	72	86	24684	7882	1025	-
	17	140	76	67	63	24714	7912	1029	-
	18	141	76	67	63	24730	7928	1031	-
	19	142	77	67	60	24740	7938	1032	-
	20	143	77	66	56	24762	7960	1035	-
	21	144	76	67	63	24762	7960	1035	-
	22	145	76	66	59	24762	7960	1035	-

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
July	23	146	77	68	63	24762	7960	1035	-
	24	147	78	68	60	24768	7966	1036	-
	25	148	77	66	56	24778	7976	1037	-
	26	149	77	65	52	24789	7988	1038	-
	27	150	76	65	55	24792	7990	1039	-

Sample No. 3-R-7

Compressive strength 2778 psi

Date Poured Feb. 23/59

Stress applied 1185 psi

Age at loading 7 days

Initial deformation 1373×10^{-6} in/in

Age at unloading

Initial recovery 491×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
March	2	Initial	76	69	70	12532	10560	1373	1421
	3	1	75	66	63	14405	1873	243	282
	4	2	75	66	63	14908	2376	309	323
	5	3	76	66	59	15308	2776	361	365
	6	4	75	65	59	15545	3013	392	414
	7	5	75	65	59	15796	3264	424	-
	8	6	75	65	59	16172	3640	473	490
	9	7	75	64	55	16400	3868	503	519
	10	8	75	65	59	16605	4073	529	549
	11	9	75	65	59	16776	4244	552	564
	12	10	75	64	55	16971	4439	577	595
	13	11	75	64	55	17130	4598	598	615
	14	12	75	64	55	17266	4734	615	642
	15	13	75	65	59	17942	5410	703	725
	16	14	75	64	55	18189	5657	735	757
	17	15	75	64	55	18380	5848	760	782
	18	16	75	64	55	18537	6005	781	796
	19	17	75	64	55	18628	6096	792	804
	20	18	75	65	59	18798	6266	815	826
	21	19	75	65	59	18933	6401	832	845
	22	20	75	63	51	19087	6555	852	872
	23	21	75	63	51	19270	6738	876	-
	24	22	75	63	51	19378	6846	890	902
	25	23	75	63	51	19508	6976	907	933
	26	24	75	62	48	19624	7092	922	943
	27	25	75	62	48	19739	7207	937	963
	28	26	75	63	51	-	-	-	-
	29	27	75	65	59	-	-	-	-
	30	28	75	65	59	20000	7468	971	985
	31	29	75	64	55	20084	7552	982	995
April	1	30	75	63	51	20232	7700	1001	1019
	2	31	75	62	48	20332	7800	1014	1036
	3	32	75	63	51	20464	7932	1031	1058
	4	33	75	62	48	20580	8048	1046	1061
	5	34	75	62	48	20669	8137	1058	1078
	6	35	75	61	44	20693	8161	1061	1098
	7	36	75	62	48	20728	8196	1065	-
	8	37	75	66	63	20842	8310	1080	1120
	9	38	75	65	59	20872	8340	1084	1120
	1o	39	75	63	51	20992	8460	1100	1120
	11	40	75	62	48	21164	8632	1122	-
	12	41	75	62	48	21240	8708	1132	1169
	13	42	75	62	48	21375	8843	1150	1174

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
April	14	43	75	66	63	21480	8948	1163	1188
	15	44	75	63	51	21558	9026	1173	1191
	16	45	75	63	51	21615	9083	1181	1213
	17	46	75	63	51	21717	9185	1194	1223
	18	47	75	63	51	21800	9268	1207	1227
	19	48	75	63	51	21873	9341	1214	1235
	20	49	75	63	51	21920	9388	1220	1237
	21	50	75	64	55	21970	9438	1227	1247
	22	51	75	65	59	22012	9380	1232	1252
	23	52	75	65	59	22050	9518	1237	1262
	24	53	75	66	63	22109	9577	1245	1267
	25	54	75	65	59	22167	9635	1253	1267
	26	55	75	65	59	22246	9714	1263	1294
	27	56	74	64	58	22311	9779	1271	1294
	28	57	75	65	59	22364	9832	1278	1286
	29	58	75	65	59	22405	9873	1283	1294
	30	59	-	-	-	-	-	-	-
May	1	60	74	65	62	22478	9946	1293	1318
	2	61	75	64	55	22543	10011	1301	-
	3	62	74	68	74	22507	9975	1297	1328
	4	63	74	67	70	22500	9968	1296	1323
	5	64	74	63	54	22619	10087	1311	-
	6	65	75	66	63	22690	10158	1321	1340
	7	66	75	66	63	23289	10757	1398	1404
	8	67	75	64	55	23362	10830	1408	1421
	9	68	74	66	66	23439	10907	1418	1438
	10	69	74	66	66	23494	10962	1425	1448
	11	70	74	66	66	23580	11048	1436	-
	12	71	75	65	59	23660	11128	1447	1455
	13	72	75	62	48	23726	11194	1455	1465
	14	73	75	63	51	23792	11260	1464	1468
	15	74	-	-	-	23840	11308	1470	-
	16	75	75	64	55	23878	11346	1475	-
	17	76	75	64	55	23899	11367	1478	-
	18	77	75	64	55	23977	11445	1488	1492
	19	78	75	65	59	23950	11418	1484	1495
	20	79	75	65	59	23987	11455	1489	1497
	21	80	75	65	59	24086	11554	1502	1504
	22	81	-	-	-	-	-	-	-
	23	82	75	63	51	24211	11679	1518	1531
	24	83	75	64	55	24260	11728	1525	1536
	25	84	75	62	48	24263	11831	1538	1548
	26	85	75	62	48	24335	12803	1664	-
	27	86	75	67	66	00227	12695	1650	1637
	28	87	75	64	55	00359	12827	1668	1659
	29	88	75	64	55	00378	12846	1670	1659
	30	89	75	64	55	00371	12839	1669	-
	31	90	-	-	-	-	-	-	-
June	1	91	75	65	59	00458	12926	1680	1671
	2	92	75	65	59	00515	12983	1688	1678
	3	93	75	65	59	00559	13027	1694	1681

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June	4	94	75	65	59	00623	13091	1702	1688
	5	95	75	65	59	00708	13176	1713	1705
	6	96	75	65	59	00739	13207	1717	1717
	7	97	75	65	59	00802	13270	1725	1720
	8	98	75	64	55	00848	13316	1731	1730
	9	99	75	65	59	00881	13349	1735	-
	10	100	75	66	63	00905	13373	1738	1737
	11	101	75	66	63	00902	13370	1738	-
	12	102	75	68	70	00885	13353	1736	1720
	13	103	75	65	59	00909	13377	1739	1727
	14	104	75	68	70	00892	13360	1737	-
	15	105	75	65	59	00941	13409	1743	1742
	16	106	75	68	70	00971	13439	1747	-
	17	107	75	66	63	00996	13464	1750	1742
	18	108	75	66	63	01002	13470	1751	-
	19	109	75	65	59	01042	13510	1756	1749
	20	110	75	64	55	01092	13560	1763	-
	21	111	75	65	59	01123	13591	1767	1759
	22	112	75	68	70	01182	13650	1775	-
	23	113	75	64	55	01232	13700	1781	-
	24	114	75	64	55	01274	13742	1786	-
	25	115	75	64	55	01324	13792	1793	1774
	26	116	75	63	51	01380	13848	1800	-
	27	117	75	67	66	01323	13791	1793	-
	28	118	75	67	66	01288	13756	1788	-
	29	119	75	65	59	01250	13718	1783	1771
	30	120	75	67	66	01263	13731	1785	1776
July	1	121	75	65	59	01340	13808	1795	-
	2	122	75	61	44	21850	9318	1211	-
	3	123	75	62	48	21745	9213	1198	-
	4	124	-	-	-	-	-	-	-
	5	125	75	67	66	21739	9207	1197	-
	6	126	75	65	59	21755	9223	1199	-
	7	127	75	63	51	21750	9218	1198	-
	8	128	75	64	55	21729	9197	1196	-
	9	129	-	-	-	-	-	-	-
	10	130	75	65	59	21665	9133	1186	-
	11	131	75	65	59	21623	9091	1182	-
	12	132	75	65	59	21620	9088	1181	-
	13	133	77	65	52	21623	9091	1182	-
	14	134	77	67	60	21623	9091	1182	-
	15	135	75	75	100	21340	8808	1145	-
	16	136	75	72	86	21220	8688	1129	-
	17	137	76	67	63	21260	8728	1135	-
	18	138	76	67	63	21275	8743	1137	-
	19	139	77	67	60	21288	8756	1138	-
	20	140	77	66	56	21310	8778	1141	-
	21	141	76	67	63	21310	8778	1141	-
	22	142	76	66	59	21312	8780	1141	-
	23	143	77	68	63	21315	8783	1142	-
	24	144	78	68	60	21320	8788	1142	-
	25	145	77	66	56	21338	8806	1145	-
	26	146	77	65	52	21352	8820	1147	-
	27	147	76	65	55	21352	8823	1147	-

Creep of Concrete

Sample No. 3-R-28

Date Poured Feb. 23/59

Age at loading 28 days

Age at unloading

Compressive strength 4069 psi

Stress applied 1831 psi

Initial deformation 2408×10^{-6} in/in

Initial recovery 660×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
March	23	Initial	75	63	51	20511	18529	2408	2276
	24	1	75	63	51	22462	1951	254	254
	25	2	75	63	51	23012	2501	325	355
	26	3	75	62	48	23340	2829	368	382
	27	4	75	62	48	23605	3094	402	426
	28	5	75	63	51	-	-	-	-
	29	6	75	65	59	-	-	-	-
	30	7	75	65	59	24161	3650	475	492
	31	8	75	64	55	24326	3815	496	505
April	1	9	75	63	51	24549	4038	525	539
	2	10	75	62	48	24706	4195	545	564
	3	11	75	63	51	24905	4394	571	583
	4	12	75	62	48	00060	4549	591	605
	5	13	75	62	48	00216	4705	612	622
	6	14	75	61	44	00354	4843	630	636
	7	15	75	62	48	00800	5289	688	686
	8	16	75	66	63	00903	5392	701	698
	9	17	75	65	59	00978	5467	711	713
	10	18	75	63	51	01147	5636	733	730
	11	19	75	62	48	01378	5867	763	-
	12	20	75	62	48	01471	5960	775	782
	13	21	75	62	48	01643	6132	797	794
	14	22	75	66	63	01780	6269	815	806
	15	23	75	63	51	01898	6387	830	821
	16	24	75	63	51	01981	6470	841	835
	17	25	75	63	51	02120	6609	859	856
	18	26	75	63	51	02229	6718	873	870
	19	27	75	63	51	02327	6816	886	884
	20	28	75	63	51	02300	6889	896	894
	21	29	75	64	55	02478	6967	906	897
	22	30	75	65	59	02538	7024	913	904
	23	31	75	65	59	02589	7078	920	916
	24	32	75	66	63	02656	7145	929	919
	25	33	75	65	59	02729	7218	938	929
	26	34	75	65	59	02819	7308	950	951
	27	35	74	64	58	02892	7381	960	953
	28	36	75	65	59	02961	7450	969	943
	29	37	75	65	59	03013	7502	975	958
	30	38	-	-	-	-	-	-	-
May	1	39	74	65	62	03111	7600	988	973
	2	40	75	64	55	03182	7671	997	-
	3	41	74	68	74	03171	7660	996	1000
	4	42	74	67	70	03180	7669	997	992

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
May	5	43	74	63	54	03325	7814	1016	-
	6	44	75	66	63	03413	7902	1027	1014
	7	45	75	66	63	04293	8782	1142	1054
	8	46	75	64	55	04391	8880	1154	1129
	9	47	74	66	66	04500	8989	1169	1156
	10	48	74	66	66	04583	9072	1179	1164
	11	49	74	66	66	04706	9195	1195	-
	12	50	75	65	59	04784	9273	1205	1176
	13	51	75	62	48	04882	9371	1218	1191
	14	52	75	63	51	04965	9454	1229	1201
	15	53	-	-	-	05023	9512	1237	-
	16	54	75	64	55	05081	9570	1244	-
	17	55	75	64	55	05117	9606	1249	-
	18	56	75	64	55	05216	9705	1262	1235
	19	57	75	65	59	05212	9701	1261	1232
	20	58	75	65	59	05286	9775	1271	1242
	21	59	75	65	59	05399	9888	1285	1250
	22	60	-	-	-	-	-	-	-
	23	61	75	63	51	05558	10047	1306	1284
	24	62	75	64	55	05603	10092	1312	1289
	25	63	75	62	48	05729	10218	1329	1299
	26	64	75	62	48	05779	10268	1335	1306
	27	65	75	67	66	05758	10247	1332	1296
	28	66	75	64	55	05815	10304	1340	1313
	29	67	75	64	55	05812	10301	1339	1313
	30	68	75	64	55	05778	10267	1335	-
	31	69	-	-	-	-	-	-	-
June	1	70	75	65	59	05841	10330	1343	1318
	2	71	75	65	59	05891	10380	1349	1330
	3	72	75	65	59	05920	10409	1353	1328
	4	73	75	65	59	05970	10459	1360	1330
	5	74	75	65	59	06040	10529	1369	1350
	6	75	75	65	59	06063	10552	1372	1352
	7	76	75	65	59	06212	10701	1391	1365
	8	77	75	64	55	06258	10747	1397	1374
	9	78	75	65	59	06280	10769	1400	-
	10	79	75	66	63	06310	10799	1404	1372
	11	80	75	66	63	06300	10789	1403	-
	12	81	75	68	70	06273	10762	1399	1374
	13	82	75	65	59	06308	10797	1404	1374
	14	83	75	68	70	06278	10767	1400	-
	15	84	75	65	59	06339	10828	1408	1394
	16	85	75	68	70	06358	10847	1410	-
	17	86	75	66	63	06380	10869	1413	1394
	18	87	75	66	63	06388	10877	1414	-
	19	88	75	65	59	06434	10923	1420	1397
	20	89	75	64	55	06460	10949	1423	-
	21	90	75	65	59	06480	10969	1426	1397
	22	91	75	68	70	06543	11032	1434	-
	23	92	75	64	55	06595	11084	1441	-
	24	93	75	64	55	06638	11127	1447	-

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June	25	94	75	64	55	06680	11169	1452	1421
	26	95	75	63	51	06730	11219	1458	-
	27	96	75	67	66	06680	11169	1452	-
	28	97	75	67	66	06635	11124	1446	-
	29	98	75	65	59	06603	11092	1442	1416
	30	99	75	67	66	06623	11112	1445	1423
July	1	100	75	65	59	06700	11189	1455	-
	2	101	75	61	44	06712	11201	1456	1431
	3	102	75	62	48	06712	11201	1456	-
	4	103	-	-	-	-	-	-	-
	5	104	75	67	66	06815	11304	1470	-
	6	105	75	65	59	06905	11394	1481	1438
	7	106	75	63	51	06952	11441	1487	-
	8	107	75	64	55	06973	11462	1490	-
	9	108	-	-	-	-	-	-	-
	10	109	75	65	59	07000	11489	1494	-
	11	110	75	65	59	07040	11529	1499	-
	12	111	75	65	59	07080	11569	1504	-
	13	112	77	65	52	07120	11609	1509	-
	14	113	77	67	60	07152	11641	1513	1441
	15	114	75	75	100	07025	11514	1497	-
	16	115	75	72	82	07005	11494	1494	-
	17	116	76	67	63	07080	11569	1504	-
	18	117	76	67	63	07112	11601	1508	-
	19	118	77	67	60	07140	11629	1512	1448
	20	119	77	66	56	07181	11670	1517	-
	21	120	76	67	63	07210	11699	1520	-
	22	121	76	66	59	07240	11729	1525	-
	23	122	77	68	63	07270	11759	1529	-
	24	123	78	68	60	07290	11779	1531	-
	25	124	77	66	56	07350	11839	1539	-
	26	125	77	65	62	07369	11858	1542	1460
	27	126	76	65	55	07419	11908	1548	1487
	28	127	75	65	59	07475	11964	1555	-
	29	128	75	65	59	01900	6389	831	-
	30	129	75	65	59	01759	6248	812	-
	31	130	75	67	66	01609	6098	793	-
Aug.	1	131	-	-	-	-	-	-	-
	2	132	75	63	51	01450	5939	772	-
	3	133	75	65	59	01431	5920	770	-
	4	134	75	65	59	01422	5911	768	-
	5	135	75	64	55	01434	5923	770	-
	6	136	75	65	59	01432	5921	770	-
	7	137	75	65	59	01360	5849	760	-
	8	138	76	65	55	01350	5839	759	-
	9	139	75	66	63	01308	5797	754	-

Creep of Concrete

Sample No. 4-R-3

Date Poured Feb. 23/59

Age at loading 3 days

Age at unloading

Compressive strength 2026 psi

Stress applied 900 psi

Initial deformation 1399×10^{-6} in/in

Initial recovery 448×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
Feb.	26	Initial	75	62	48	19725	10763	1399	1587
	27	1	75	66	63	20570	845	110	118
	28	2	75	65	59	21233	1508	196	216
March	1	3	75	65	62	21595	1870	243	255
	2	4	76	69	70	21928	2203	286	279
	3	5	75	66	63	22161	2436	317	326
	4	6	75	66	63	22363	2638	343	385
	5	7	76	66	59	22725	3000	390	441
	6	8	75	65	59	22889	3164	411	480
	7	9	75	65	59	23070	3345	435	-
	8	10	75	65	59	23285	3560	463	542
	9	11	75	64	55	23462	3737	486	573
	10	12	75	65	59	23605	3880	503	568
	11	13	75	65	59	23710	3985	518	610
	12	14	75	64	55	23877	5142	540	605
	13	15	75	64	55	24010	4285	557	622
	14	16	75	64	55	24100	4375	569	635
	15	17	75	65	59	24232	4507	586	637
	16	18	75	64	55	24362	4637	603	657
	17	19	75	64	55	24456	4731	615	671
	18	20	75	64	55	24535	5810	625	688
	19	21	75	64	55	24597	4873	633	688
	20	22	75	65	59	24724	4999	650	696
	21	23	75	65	59	24830	5105	664	708
	22	24	75	63	51	24922	5197	767	737
	23	25	75	63	51	25068	5343	695	-
	24	26	75	63	51	25122	5397	702	750
	25	27	75	63	51	25200	5474	712	779
	26	28	75	62	48	25292	5567	724	789
	27	29	75	62	48	25365	5640	733	806
	28	30	75	63	51	-	-	-	-
	29	31	75	65	59	-	-	-	-
	30	32	75	65	59	25535	5810	755	813
	31	33	75	64	55	25593	5868	763	818
April	1	34	75	63	51	25682	5957	774	835
	2	35	75	62	48	25771	6046	786	840
	3	36	75	63	51	00880	6155	800	843
	4	37	75	62	48	00932	6207	807	858
	5	38	75	62	48	01015	6290	817	867
	6	39	75	61	44	01099	6374	829	887
	7	40	75	62	48	01197	6473	841	-
	8	41	75	66	63	01351	6626	861	894
	9	42	75	65	59	01356	6631	862	911

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
April	10	43	75	63	51	01450	6725	873	907
	11	44	75	62	48	01594	6869	893	-
	12	45	75	62	48	01619	6894	8696	943
	13	46	75	62	48	01732	7007	911	946
	14	47	75	66	63	01808	7083	921	970
	15	48	75	63	51	01882	7157	930	960
	16	49	75	63	51	01892	7167	932	980
	17	50	75	63	51	01979	7254	943	990
	18	51	75	63	51	02031	7306	950	992
	19	52	75	63	51	02090	7365	957	997
	20	53	75	63	51	02162	7437	967	1007
	21	54	75	64	55	02203	7478	972	1012
	22	55	75	65	59	02223	7497	975	1009
	23	56	75	65	59	02234	7509	976	1002
	24	57	75	65	63	02264	7539	980	1000
	25	58	75	65	59	02328	7603	988	1022
	26	59	75	65	59	02381	7656	995	1027
	27	60	74	64	58	02447	7722	1004	1027
	28	61	75	65	59	02482	7757	1008	1029
	29	62	75	65	59	02522	7797	1014	1036
	30	63	-	-	-	-	-	-	-
May	1	64	75	64	62	02572	7847	1020	1041
	2	65	75	64	55	02612	7887	1025	-
	3	66	74	68	74*	02596	7871	1023	1041
	4	67	74	67	70	02571	7846	1020	1036
	5	68	74	63	54	02645	7920	1030	-
	6	69	75	66	63	02695	7970	1036	1061
	7	70	75	66	63	03488	8763	1139	1085
	8	71	75	64	55	03519	8794	1143	1107
	9	72	75	66	66	03555	8830	1148	1120
	10	73	74	66	66	03587	8862	1152	1127
	11	74	74	66	66	03625	8900	1157	-
	12	75	75	65	59	03709	8984	1168	1127
	13	76	75	62	48	03725	9000	1170	1134
	14	77	75	63	51	03770	9045	1176	1129
	15	78	-	-	-	03799	9074	1180	-
	16	79	75	64	55	03855	9130	1187	-
	17	80	75	64	55	03855	9130	1187	-
	18	81	75	64	55	03858	9133	1187	1153
	19	82	75	65	59	03860	9135	1188	1156
	20	83	75	65	59	03860	9135	1188	1154
	21	84	75	65	59	03902	9177	1193	1156
	22	85	-	-	-	-	-	-	-
	23	86	75	63	51	03994	9269	1205	1181
	24	87	75	65	55	04009	9284	1207	1186
	25	88	75	62	48	04113	9388	1220	1178
	26	89	75	62	48	04172	9447	1228	-
	27	90	75	67	66**	04728	10003	1300	1264
	28	91	75	64	55	04796	10071	1309	1291
	29	92	75	64	55	04800	10075	1310	1286
	30	93	75	64	55	04790	10065	1308	-
	31	94	-	-	-	-	-	-	-

* Light Weight Started

** Compressometer spring found unhooked. Spring rehooked, readings continued

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June	1	95	75	65	59	04802	10077	1310	1291
	2	96	75	65	59	04843	10118	1315	1299
	3	97	75	65	59	04888	10163	1321	1303
	4	98	75	65	59	04926	10201	1326	1301
	5	99	75	65	59	05000	10275	1336	1308
	6	100	75	65	59	05012	10287	1337	1311
	7	101	75	65	59	05105	10380	1349	1330
	8	102	75	64	55	05137	10412	1354	1345
	9	103	75	65	59	05160	10435	1357	-
	10	104	75	66	63	05179	10454	1359	1343
	11	105	75	66	63	05181	10456	1359	-
	12	106	75	68	70	05154	10429	1356	1335
	13	107	75	65	59	05154	10429	1356	1340
	14	108	75	68	70	05145	10420	1355	-
	15	109	75	65	59	05161	10436	1357	1345
	16	110	75	68	70	05161	10436	1357	-
	17	111	75	66	63	05180	10455	1359	1352
	18	112	75	66	63	05182	10457	1359	-
	19	113	75	65	59	05195	10470	1361	1355
	20	114	75	64	55	05246	10521	1368	-
	21	115	75	65	59	05258	10533	1369	1360
	22	116	75	68	70	05270	10545	1371	-
	23	117	75	64	55	05305	10580	1375	-
	24	118	75	64	55	05341	10616	1380	-
	25	119	75	64	55	05398	10673	1387	1382
	26	120	75	63	51	05422	10697	1391	-
	27	121	75	67	66	05400	10675	1388	-
	28	122	75	67	66	05368	10643	1384	-
	29	123	75	65	59	05335	10610	1379	1355
	30	124	75	67	66	05310	10585	1376	1362
July	1	125	75	65	59	05377	10652	1385	-
	2	126	75	61	44	01673	6948	903	-
	3	127	75	62	48	01595	6870	893	-
	4	128	-	-	-	-	-	-	-
	5	129	75	67	66	01593	6868	893	-
	6	130	75	65	59	01600	6875	894	-
	7	131	75	63	51	01610	6885	895	-
	8	132	75	64	55	01610	6885	895	-
	9	133	-	-	-	-	-	-	-
	10	134	75	65	59	01570	6845	890	-
	11	135	75	65	59	01557	6832	888	-
	12	136	75	65	59	01557	6832	888	-
	13	137	77	65	52	01559	6834	888	-
	14	138	77	67	60	01563	6838	889	-
	15	139	75	65	100	01364	6639	863	-
	16	140	75	72	86	01260	6535	850	-
	17	141	76	67	63	01264	6539	850	-
	18	142	76	67	63	01275	6550	852	-
	19	143	77	67	60	01278	6553	852	-
	20	144	77	66	56	01292	6567	854	-
	21	145	76	67	63	01300	6575	855	-

Creep of Concrete: Page --4-- Sample No. 4-R-3 196

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
July	22	146	76	66	59	01300	6575	855	-
	23	147	77	68	63	01310	6585	856	-
	24	148	78	68	60	01320	6595	857	-
	25	149	77	66	56	01326	6601	858	-
	26	150	77	65	52	01332	6607	859	-
	27	151	76	65	55	01375	6650	865	-

Creep of Concrete

Sample No. 4-R-28

Date Poured Feb. 23/1959

Age at loading 28 days

Age at unloading

Compressive strength 5087 psi

Stress applied 2289 psi

Initial deformation 1401×10^{-6} in/in

Initial recovery 705×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
March	23	Initial			51	16810	10778	1401	1624
	24	1			51	18322	1512	197	203
	25	2	75	63	51	18910	2100	273	296
	26	3	75	62	48	19276	2466	321	336
	27	4	75	62	48	19448	2738	356	377
	28	5	75	63	51	-	-	-	-
	29	6	75	65	59	-	-	-	-
	30	7	75	65	59	20132	3322	432	448
	31	8	75	64	55	20309	3499	455	463
April	1	9	75	63	51	20545	3735	486	505
	2	10	75	62	48	20705	3895	506	527
	3	11	75	63	51	20898	4088	531	541
	4	12	75	62	48	21065	4255	553	566
	5	13	75	62	48	21245	4435	577	586
	6	14	75	61	44	21380	4570	594	595
	7	15	75	62	48	21745	4935	642	652
	8	16	75	66	63	21820	5010	651	666
	9	17	75	65	59	21906	5096	662	671
	10	18	75	63	51	22092	5282	687	693
	11	19	75	62	48	22331	5521	718	-
	12	20	75	62	48	22428	5618	730	733
	13	21	75	62	48	22626	5816	756	755
	14	22	75	66	63	22778	5968	776	777
	15	23	75	63	51	22889	6079	790	786
	16	24	75	63	51	22959	6149	799	811
	17	25	75	63	51	23111	6301	819	831
	18	26	75	63	51	23219	6409	833	843
	19	27	75	63	51	23318	6508	846	860
	20	28	75	63	51	23395	6585	856	870
	21	29	75	64	55	23484	6674	868	862
	22	30	75	65	59	23550	6740	876	862
	23	31	75	65	59	23587	6777	881	894
	24	32	75	65	63	23661	6851	891	902
	25	33	75	65	59	23763	6953	904	904
	26	34	75	65	59	23854	7044	916	933
	27	35	74	64	58	23961	7151	930	933
	28	36	75	65	59	24031	7221	939	931
	29	37	75	65	59	24098	7288	947	943
	30	38	-	-	-	-	-	-	-
May	1	39	75	64	62	24215	7405	963	951
	2	40	75	64	55	24300	7490	974	-
	3	41	74	68	74	24295	7485	973	992
	4	42	74	67	70	24302	7492	974	987

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
May	5	43	74	63	54	24425	7615	990	-
	6	44	75	66	63	24515	7705	1002	1007
	7	45	75	66	63	24785	7975	1037	1054
	8	46	75	64	55	24830	8020	1043	1073
	9	47	74	66	66	24883	8073	1049	1095
	10	48	74	66	66	24935	8125	1056	1103
	11	49	74	66	66	24995	8185	1064	-
	12	50	75	65	59	00082	8272	1075	1112
	13	51	75	62	48	00198	8388	1090	1112
	14	52	75	63	51	00260	8450	1099	1112
	15	53	-	-	-	00320	8510	1106	-
	16	54	75	64	55	00390	8580	1115	-
	17	55	75	64	55	00455	8645	1124	-
	18	56	75	64	55	00518	8708	1132	1147
	19	57	75	65	59	00523	8713	1133	1156
	20	58	75	65	59	00543	8733	1135	1164
	21	59	75	65	59	00617	8807	1145	1169
	22	60	-	-	-	-	-	-	-
	23	61	75	63	51	00749	8939	1162	1203
	24	62	75	64	55	00772	8962	1165	1208
	25	63	75	62	48	00928	9118	1185	1205
	26	64	75	62	48	01083	9273	1205	1220
	27	65	75	67	66	01080	9270	1205	1213
	28	66	75	64	55	01573	9763	1269	1264
	29	67	75	64	55	01598	9788	1272	1262
	30	68	75	64	55	01583	9773	1270	-
	31	69	-	-	-	-	-	-	-
June	1	70	75	65	59	01679	9869	1283	1281
	2	71	75	65	59	01748	9938	1292	1289
	3	72	75	65	59	01791	9981	1298	1296
	4	73	75	65	59	01841	10031	1304	1301
	5	74	75	65	59	01934	10124	1316	1306
	6	75	75	65	59	01972	10162	1321	1318
	7	76	75	65	59	02068	10258	1334	1340
	8	77	75	64	55	02115	10305	1340	1348
	9	78	75	65	59	02150	10340	1344	-
	10	79	75	66	63	02188	10378	1349	1355
	11	80	75	66	63	02184	10374	1349	-
	12	81	75	68	70	02165	10355	1346	1350
	13	82	75	65	59	02196	10386	1350	1360
	14	83	75	68	70	02322	10512	1367	-
	15	84	75	65	59	02402	10592	1377	1392
	16	85	75	68	70	02433	10623	1381	-
	17	86	75	66	63	02468	10658	1386	1406
	18	87	75	66	63	02483	10673	1387	-
	19	88	75	65	59	02539	10729	1395	1401
	20	89	75	64	55	02585	10775	1401	-
	21	90	75	65	59	02698	10888	1415	1423
	22	91	75	68	70	02775	10965	1425	-
	23	92	75	64	55	02838	11028	1434	-
	24	93	75	64	55	02885	11075	1440	-

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June	25	94	75	64	55	02948	11138	1448	1448
	26	95	75	63	51	03004	11194	1455	-
	27	96	75	67	66	02958	11148	1449	-
	28	97	75	67	66	02937	11127	1447	-
	29	98	75	65	59	02914	11104	1444	1448
	30	99	75	67	66	02936	11126	1446	1453
July	1	100	75	65	59	03010	11200	1456	-
	2	101	75	61	44	03030	11220	1459	1455
	3	102	75	62	48	03031	11221	1459	-
	4	103	-	-	-	-	-	-	-
	5	104	75	67	66	03151	11341	1474	-
	6	105	75	65	59	03245	11435	1487	1463
	7	106	75	63	51	03295	11485	1493	-
	8	107	75	64	55	03320	11510	1496	-
	9	108	-	-	-	-	-	-	-
	10	109	75	65	59	03352	11542	1500	-
	11	110	75	65	59	03397	11587	1506	-
	12	111	75	65	59	03440	11630	1512	-
	13	112	77	65	52	03483	11673	1517	-
	14	113	77	67	60	03532	11722	1525	1472
	15	114	75	75	100	03429	11619	1510	-
	16	115	75	72	82	03416	11606	1509	-
	17	116	76	67	63	03470	11660	1516	-
	18	117	76	67	63	03509	11699	1521	-
	19	118	77	67	60	03538	11728	1525	1482
	20	119	77	66	56	03595	11785	1532	-
	21	120	76	67	63	03621	11811	1535	-
	22	121	76	66	59	03659	11849	1540	-
	23	122	77	68	63	03690	11880	1544	-
	24	123	78	68	60	03710	11900	1547	-
	25	124	77	66	56	03780	11970	1556	-
	26	125	77	65	52	03798	11988	1558	1490
	27	126	76	65	55	03860	12050	1566	1514
	28	127	75	65	59	03913	12103	1573	-
	29	128	75	65	59	22695	5885	765	-
	30	129	75	65	59	22560	5750	748	-
	31	130	75	67	66	22400	5590	727	-
Aug.	1	131	-	-	-	-	-	-	-
	2	132	75	63	51	22230	5420	705	-
	3	133	75	65	59	22203	5393	701	-
	4	134	75	65	59	22191	5381	700	-
	5	135	75	64	55	22190	5380	699	-
	6	136	75	65	59	22192	5382	700	-
	7	137	75	65	59	22178	5368	698	-
	8	138	76	65	55	22173	5363	697	-
	9	139	75	66	63	22138	5328	693	-

Creep of Concrete

Sample No. 5-R-3

Compressive strength 3191 psi

Date Poured Feb. 23/59

Stress applied 1522 psi

Age at loading 3 days

Initial deformation 1650×10^{-6} in/in

Age at unloading

Initial recovery 494×10^{-6} in/in

Date	Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
Feb. 26	Initial	75	62	48	18558	12694	1650	1803
27	1	75	66	63	20389	1831	238	127
28	2	75	65	59	20235	1677	218	242
Mar. 1	3	74	65	62	21762	3204	417	304
2	4	76	69	70	21240	2682	349	350
3	5	75	66	63	22569	4011	521	424
4	6	75	66	63	22858	4300	559	490
5	7	76	66	59	23112	4554	592	522
6	8	75	65	59	23271	4713	613	454
7	9	75	65	59	23409	4851	631	-
8	10	75	65	59	23609	5051	657	500
9	11	75	64	55	23803	5245	682	522
10	12	75	65	59	23943	5385	700	546
11	13	75	65	59	24051	5493	713	568
12	14	75	64	55	24225	5667	737	588
13	15	75	64	55	24330	5772	750	588
14	16	75	64	55	24411	5853	761	617
15	17	75	65	59	24585	6027	784	640
16	18	75	64	55	24740	6182	804	657
17	19	75	64	55	24850	6292	818	660
18	20	75	64	55	24947	6389	831	660
19	21	75	64	55	25006	6448	838	686
20	22	75	65	59	25136	6578	855	709
21	23	75	65	59	25231	6673	878	693
22	24	75	63	51	24336	6778	881	722
23	25	75	63	51	25475	6917	899	-
24	26	75	63	51	25538	6980	907	728
25	27	75	63	51	25628	7070	919	761
26	28	75	62	48	25712	7154	930	761
27	29	75	62	48	25795	7237	941	755
28	30	75	63	51	-	-	-	-
29	31	75	65	59	-	-	-	-
30	32	75	65	59	25969	7411	963	800
31	33	75	64	55	01012	7454	969	804
Apr. 1	34	75	63	51	01114	7556	982	810
2	35	75	62	48	01199	7641	993	826
3	36	75	63	51	01292	7734	1005	820
4	37	75	62	48	01375	7817	1016	853
5	38	75	62	48	01440	7882	1025	846
6	39	75	61	44	01532	7974	1037	875
7	40	75	62	48	01580	8022	1043	-
8	41	75	66	63	01830	8272	1075	875
9	42	75	65	59	01838	8280	1076	872

Note: Demec. based on average of three gage lengths only.
Two sets gage holes very poor.

Date	Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
Apr. 10	43	75	63	51	01912	8354	1086	885
11	44	75	62	48	02050	8492	1104	-
12	45	75	62	48	02104	8546	1111	915
13	46	75	62	48	02201	8643	1124	911
14	47	75	66	63	02278	8720	1134	908
15	48	75	63	51	02336	8778	1141	924
16	49	75	63	51	02376	8818	1146	941
17	50	75	63	51	02449	8891	1156	957
18	51	75	63	51	02506	8948	1163	954
19	52	75	63	51	02551	8993	1169	957
20	53	75	63	51	02587	9029	1174	967
21	54	75	64	55	02613	9055	1177	964
22	55	75	65	59	02635	9077	1180	944
23	56	75	65	59	02652	9094	1182	967
24	57	75	66	63	02681	9123	1186	967
25	58	75	65	59	02732	9173	1193	967
26	59	75	65	59	02792	9234	1200	987
27	60	74	64	58	02843	9284	1207	983
28	61	75	65	59	02878	9320	1212	987
29	62	75	65	59	02908	9350	1216	977
30	63	-	-	-	-	-	-	-
May 1	64	74	65	62	02949	9391	1221	980
2	65	75	64	55	02998	9440	1227	-
3	66	74	68	74 *	02950	9392	1221	1016
4	67	74	67	70	02930	9372	1218	1016
5	68	74	63	54	03036	9478	1232	-
6	69	75	66	63	03090	9532	1239	1026
7	70	75	66	63	03160	9602	1248	1036
8	71	75	64	55	03201	9643	1254	1046
9	72	74	66	66	03246	9688	1259	1046
10	73	74	66	66	03276	9718	1263	1058
11	74	74	66	66	03322	9764	1269	-
12	75	75	65	59	03370	9812	1276	1058
13	76	75	62	48	03410	9852	1281	1058
14	77	75	63	51	03432	9784	1284	1062
15	78	-	-	-	03452	9894	1286	-
16	79	75	64	55	03476	9918	1289	-
17	80	75	65	55	03476	9918	1289	-
18	81	75	65	55	03529	9971	1296	1068
19	82	75	65	59	03470	9912	1289	1065
20	83	75	65	59	03482	9924	1290	1068
21	84	75	65	59	03542	9984	1298	1075
22	85	-	-	-	-	-	-	-
23	86	75	63	51	03640	10082	1311	1098
24	87	75	64	55	03673	10115	1315	1117
25	88	75	62	48	03753	10195	1325	1111
26	89	75	62	48	03753	10195	1325	-
27	90	75	67	66**	04259	10701	1391	-
28	91	75	64	55	04348	10790	1403	1258
29	92	75	64	55	04339	10781	1402	1248
30	93	75	64	55	04302	10744	1397	-
31	94	-	-	-	-	-	-	-

* Light Weight Started

** Humidifier repaired.

Date	Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June 1	95	75	65	59	04342	10784	1402	1245
2	96	75	65	59	04379	10821	1407	1248
3	97	75	65	59	04405	10847	1410	1254
4	98	75	65	59	04429	10781	1413	1254
5	99	75	65	59	04501	10943	1423	1267
6	100	75	65	59	04518	10960	1425	1277
7	101	75	65	59	04605	11047	1436	1303
8	102	75	64	55	04635	11077	1440	1310
9	103	75	65	59	04643	11085	1441	-
10	104	75	66	63	04663	11105	1444	1294
11	105	75	66	63	04648	11090	1442	-
12	106	75	68	70	04610	11052	1437	1310
13	107	75	65	59	04621	11063	1438	1310
14	108	75	68	70	04595	11037	1435	-
15	109	75	65	59	04625	11067	1439	1300
16	110	75	68	70	04635	11077	1440	-
17	111	75	66	63	04642	11084	1441	1307
18	112	75	66	63	04640	11082	1441	-
19	113	75	65	59	04662	11104	1444	1310
20	114	75	64	55	04708	11150	1450	-
21	115	75	65	59	04882	11324	1472	1326
22	116	75	68	70	04928	11370	1478	-
23	117	75	64	55	04973	11415	1484	-
24	118	75	64	55	05010	11452	1489	-
25	119	75	64	55	05060	11502	1495	1333
26	120	75	63	51	05100	11542	1500	-
27	121	75	67	66	05028	11470	1491	-
28	122	75	67	66	04985	11427	1486	-
29	123	75	65	59	04948	11390	1481	1320
30	124	75	67	66	04958	11400	1482	1310
July 1	125	75	65	59	05038	11480	1492	-
2	126	75	61	44	00702	7144	929	-
3	127	75	62	48	00610	7052	917	-
4	128	-	-	-	-	-	-	-
5	129	75	67	66	00590	7032	914	-
6	130	75	65	59	00605	7047	916	-
7	131	75	63	51	00605	7047	916	-
8	132	75	64	55	00590	7032	914	-
9	133	-	-	-	-	-	-	-
10	134	75	65	59	00540	6982	908	-
11	135	75	65	59	00530	6972	906	-
12	136	75	65	59	00528	6970	906	-
13	137	77	65	52	00521	6963	905	-
14	138	77	67	60*	00525	6967	906	-
15	139	75	75	100	00295	6737	876	-
16	140	75	72	86	00190	6632	862	-
17	141	76	67	63	00200	6642	863	-
18	142	76	67	63	00213	6655	865	-
19	143	77	67	60	00213	6655	865	-
20	144	77	66	56	00229	6671	867	-
21	145	76	67	63	00229	6671	867	-

* Air compressor shut down - Drive belt broken - Temp. & Humidity controller not operating

Date	Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
July 22	146	77	66	59	00229	6671	867	-
23	147	77	67	63	00231	6673	867	-
24	148	77	68	60	00240	6682	869	-
25	149	77	66	56	00240	6682	869	-
26	150	77	65	52	00255	6697	871	-
27	151	76	65	55	00270	6712	873	-

Sample No. 5-R-7 | Compressive strength 4777 psi

Date Poured Feb. 23/59 | Stress applied 2247 psi

Age at loading 7 days | Initial deformation 2141×10^{-6} in/in

Age at unloading | Initial recovery 688×10^{-6} in/in

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
						01810			
March	2	Initial	76	69	70	18281	16471	2141	2041
	3	1	75	66	63	20489	2208	287	296
	4	2	75	66	63	21207	2926	380	382
	5	3	76	66	59	21741	3460	450	443
6	6	4	75	65	59	22049	3768	490	483
	7	5	75	65	59	22385	4104	534	-
	8	6	75	65	59	22730	4449	578	581
	9	7	75	64	55	23030	4749	617	615
	10	8	75	65	59	23242	4961	645	652
	11	9	75	65	59	23451	5170	672	679
	12	10	75	64	55	23679	5398	702	703
	13	11	75	64	55	23855	5564	723	715
	14	12	75	64	55	24000	5719	744	740
	15	13	75	65	59	24165	5884	765	757
	16	14	75	64	55	24310	6029	784	757
	17	15	75	64	55	24650	6369	828	804
	18	16	75	64	55	24786	6505	846	818
	19	17	75	64	55	24870	7589	857	818
	20	18	75	65	59	-	-	-	-
	21	19	75	65	59	25150	6869	893	845
	22	20	75	63	51	25295	7014	912	853
	23	21	75	63	51	25465	7184	934	892
	24	22	75	63	51	25565	7284	974	914
	25	23	75	63	51	25673	7392	961	946
	26	24	75	62	48	25793	7512	977	948
	27	25	75	62	48	25890	7609	989	968
	28	26	-	-	-	-	-	-	-
	29	27	-	-	-	-	-	-	-
	30	28	75	65	59	01130	7849	1020	992
	31	29	75	64	55	01202	7921	1030	1002
April	1	30	75	63	51	01334	8053	1047	1009
	2	31	75	62	48	01424	8143	1059	1031
	3	32	75	63	51	01545	8264	1074	1046
	4	33	75	62	48	01641	8360	1087	1056
	5	34	75	62	48	01734	8453	1099	1066
	6	35	75	61	44	01850	8569	1114	1078
	7	36	75	62	48	01950	8669	1127	-
	8	37	75	66	63	02033	8752	1138	1076
	9	38	75	65	59	02056	8775	1141	1080
	10	39	75	63	51	02160	8879	1154	1093
	11	40	75	62	48	02327	9046	1176	-
	12	41	75	62	48	02388	9107	1184	1125

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
April	13	42	75	62	48	02505	9224	1199	1129
	14	43	75	66	63	02600	9319	1211	1147
	15	44	75	63	51	02660	9379	1219	1147
	16	45	75	63	51	02713	9432	1226	1164
	17	46	75	63	51	02800	9519	1237	1174
	18	47	75	63	51	02865	9584	1246	1176
	19	48	75	63	51	02932	9651	1255	1183
	20	49	75	63	51	02973	9692	1260	1181
	21	50	75	64	55	03027	9746	1267	1191
	22	51	75	65	59	03055	9774	1271	1193
	23	52	75	65	59	03080	9799	1274	1201
	24	53	75	66	63	03120	9839	1279	1201
	25	54	75	65	59	03170	9889	1286	1210
	26	55	75	65	59	03248	9967	1296	1230
	27	56	74	64	58	03298	10017	1302	1232
	28	57	75	65	59	03348	10067	1309	1225
	29	58	75	65	59	03390	10109	1314	1235
	30	59	-	-	-	-	-	-	-
May	1	60	74	65	62	03440	10159	1321	1254
	2	61	75	64	55	03499	10218	1328	-
	3	62	74	68	74	03455	10174	1323	1262
	4	63	74	67	70	03450	10169	1322	1267
	5	64	74	63	54	03568	10287	1337	-
	6	65	75	66	63	03632	10351	1346	1284
	7	66	75	66	63	03856	10575	1375	1321
	8	67	75	64	55	03900	10619	1380	1306
	9	68	74	66	66	03960	10679	1388	1318
	10	69	74	66	66	03947	10666	1387	1328
	11	70	74	66	66	04006	10725	1394	-
	12	71	75	65	59	04070	1078	1403	1333
	13	72	75	62	48	04112	10831	1408	1340
	14	73	75	63	51	04155	10874	1414	1340
	15	74	-	-	-	04178	10897	1416	-
	16	75	75	64	55	04215	10934	1421	-
	17	76	75	64	55	04218	10937	1422	-
	18	77	75	64	55	04275	10994	1429	1357
	19	78	75	65	59	04235	10954	1424	1352
	20	79	75	65	59	04257	10976	1427	1357
	21	80	75	65	59	04407	11126	1446	1360
	22	81	-	-	-	-	-	-	-
	23	82	75	63	51	04502	11221	1459	1372
	24	83	75	64	55	04567	11286	1467	1367
	25	84	75	62	48	04651	11370	1478	1374
	26	85	75	62	48	04640	11359	1477	1382
	27	86	75	67	66	04608	11327	1473	1377
	28	87	75	64	55	04895	11614	1510	1416
	29	88	75	64	55	04875	11594	1507	1414
	30	89	75	64	55	04842	11461	1503-	-
	31	90	-	-	-	-	-	-	-
June	1	91	75	65	59	04880	11599	1508	1416
	2	92	75	65	59	04930	11649	1514	1414
	3	93	75	65	59	04945	11664	1516	1421

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June	4	94	75	65	59	04980	11699	1521	1421
	5	95	75	65	59	05070	11789	1533	1433
	6	96	75	65	59	05130	11849	1540	1433
	7	97	75	65	59	05350	12069	1569	1463
	8	97	75	64	55	05395	12114	1575	1475
	9	99	75	65	59	05419	12138	1578	-
	10	100	75	66	63	05443	12162	1581	1448
	11	101	75	66	63	05433	12162	1581	-
	12	102	75	68	70	05409	12128	1577	1468
	13	103	75	65	59	05433	12152	1580	1465
	14	104	75	65	59	05433	12152	1580	1465
	14	104	75	68	70	05396	12112	1575	-
	15	105	75	65	59	05437	12156	1580	1468
	16	106	75	68	70	05452	12171	1582	-
	17	107	75	66	63	05467	12186	1584	1477
	18	108	75	66	63	05468	12187	1584	-
	19	109	75	65	59	05491	12210	1587	1470
	20	110	75	64	55	05535	12254	1593	-
	21	111	75	65	59	05560	12279	1596	1494
	22	112	75	68	70	05600	12319	1601	-
	23	113	75	64	55	05643	12362	1607	-
	24	114	75	64	55	05675	12394	1611	-
	25	115	75	64	55	05727	12446	1618	1521
	26	116	75	63	51	05777	12496	1624	-
	27	117	75	67	66	05711	12430	1616	-
	28	118	75	67	66	05680	12399	1612	-
	29	119	75	65	59	05641	12360	1607	1507
	30	120	75	67	66	05650	12369	1608	1504
July	1	121	75	65	59	05715	12334	1616	-
	2	122	75	61	44	05730	12339	1618	1512
	3	123	75	62	48	05720	12439	1617	-
	4	124	-	-	-	-	-	-	-
	5	125	75	67	66	05798	12517	1627	-
	6	126	75	65	59	05870	12589	1637	1519
	7	127	75	63	51	05910	12629	1642	-
	8	128	75	64	55	05931	12650	1645	-
	9	129	-	-	-	-	-	-	-
	10	130	75	65	59	05950	12669	1647	-
	11	131	75	65	59	05987	12706	1652	-
	12	132	75	65	59	06030	12749	1657	-
	13	133	77	65	52	06060	12779	1661	-
	14	134	77	67	60	06085	12804	1665	1519
	15	135	75	75	100	05965	12684	1649	-
	16	136	75	72	86	05940	12659	1646	-
	17	137	76	67	63	05995	12714	1653	-
	18	138	76	67	63	06020	12739	1656	-
	19	139	77	67	60	06040	12749	1649	1426
	20	140	77	66	56	06080	12799	1664	
	21	141	76	67	63	06092	12811	1665	-
	22	142	76	66	59	06138	12857	1671	-

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
July	23	143	77	68	63	06155	12874	1674	-
	24	144	78	68	60	06158	12877	1674	-
	25	145	77	66	56	06215	12934	1681	-
	26	146	77	65	52	06225	12944	1683	1536
	27	147	76	65	55	06270	12989	1689	1551
	28	148	75	65	59	06353	13072	1699	
	29	149	75	65	59	00391	7110	924	-
	30	150	75	65	59	00270	6989	909	-
	31	151	75	67	66	00130	6849	890	-
Aug.	1	152	-	-	-	-	-	-	-
	2	153	75	63	51	24978	6697	871	-
	3	154	75	65	59	24954	6673	867	-
	4	155	75	65	59	24944	6663	866	-
	5	156	75	64	55	24935	6654	865	-
	6	157	75	65	59	24934	6653	865	-
	7	158	75	65	59	24930	6649	864	-
	8	159	76	65	55	24930	6649	864	-
	9	160	75	66	63	24893	6612	860	-

Creep of Concrete

Sample No. 5-R-28

Date Poured Feb. 23/59

Age at loading 28 days

Age at unloading

Compressive strength 5909 psi

Stress applied 2659 psi

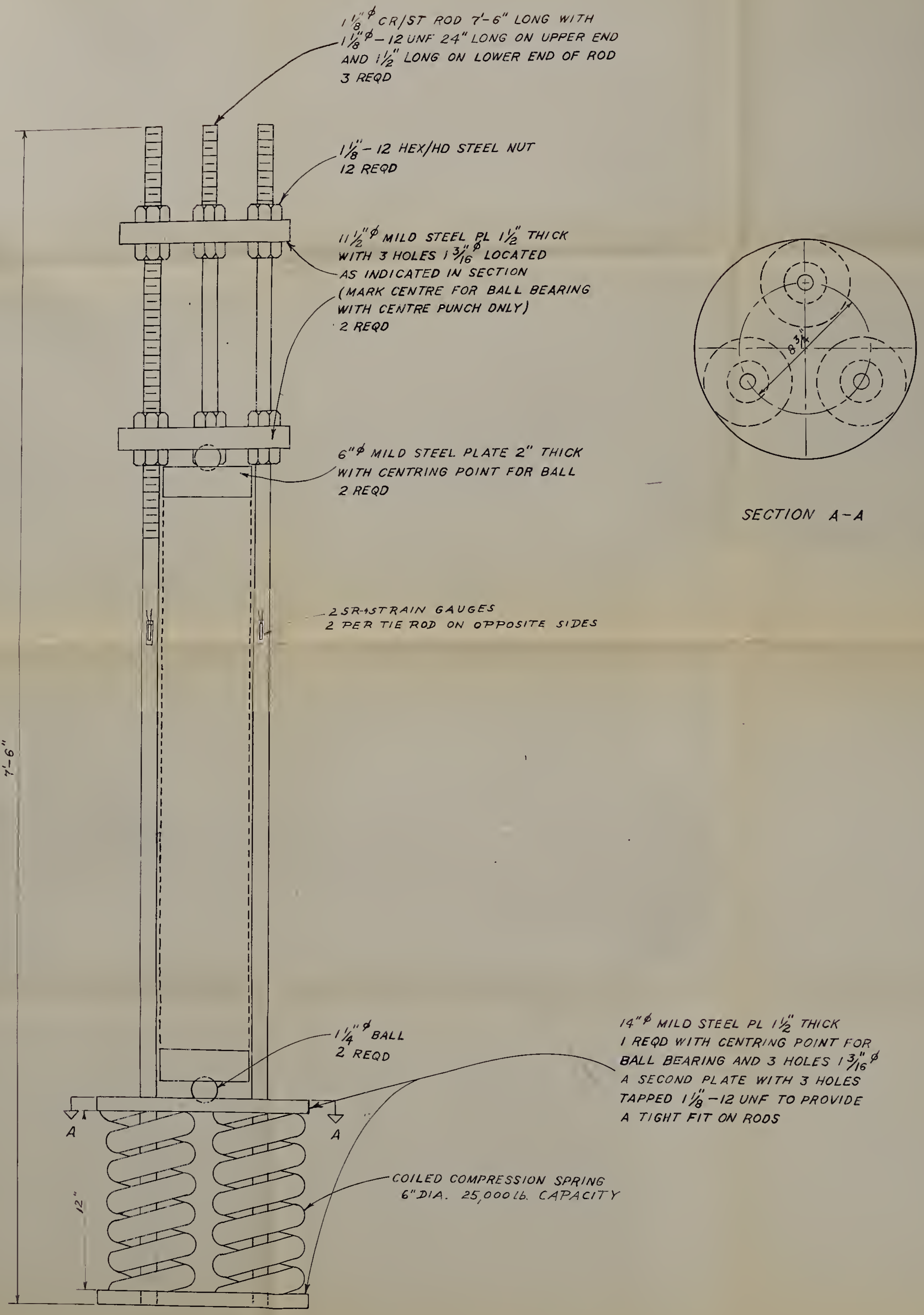
Initial deformation 1723×10^{-6} in/in

Initial recovery 798×10^{-6} in/in

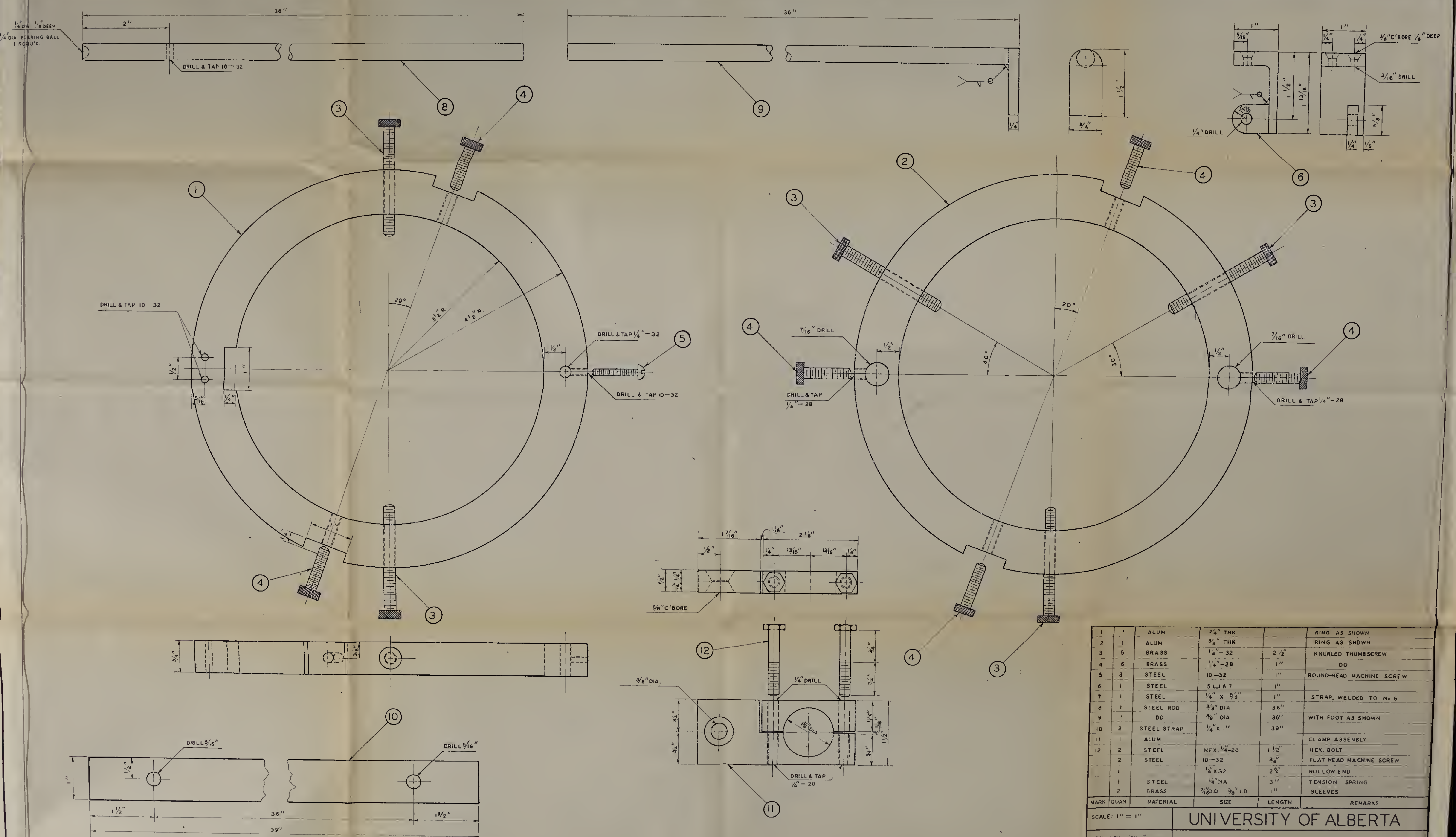
Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-5}	Accum. Diff. in. x 10^{-5}	Unit Strain "/" x 10^{-6}	Demec. Strain "/" x 10^{-6}
March	23	Initial	75	63	51	19745	13255	1723	1884
	24	1	75	63	51	21960	2215	288	309
	25	2	75	63	51	22678	2933	381	419
	26	3	75	62	48	23065	3320	432	470
	27	4	75	62	48	23412	3667	477	522
	28	5	75	63	51	-	-	-	-
	29	6	75	65	59	-	-	-	-
	30	7	75	65	59	24089	4344	565	600
	31	8	75	64	55	24303	4558	593	630
Apri.	1	9	75	63	51	24558	4813	626	659
	2	10	75	62	48	24743	4998	650	691
	3	11	75	63	51	00168	5423	705	718
	4	12	75	62	48	00358	5613	730	745
	5	13	75	62	48	00541	5796	753	764
	6	14	75	61	44	00692	5947	773	796
	7	15	75	62	48	00748	6003	780	-
	8	16	75	66	63	01082	6337	824	835
	9	17	75	65	59	01178	6433	836	853
	10	18	75	63	51	01379	6634	862	867
	11	19	75	62	48	01623	6878	894	-
	12	20	75	62	48	01743	6998	910	924
	13	21	75	62	48	09151	7206	937	938
	14	22	75	66	63	02118	7373	958	965
	15	23	75	63	51	02250	7505	976	975
	16	24	75	63	51	02348	7603	988	995
	17	25	75	63	51	02508	7763	1009	1021
	18	26	75	63	51	02628	7883	1025	1027
	19	27	75	63	51	02743	7998	1040	1039
	20	28	75	63	51	02829	8084	1051	1051
	21	29	75	64	55	02908	8163	1061	1063
	22	30	75	65	59	02987	8242	1071	1071
	23	31	75	65	59	03098	8353	1086	1080
	24	32	75	65	63	03168	8423	1095	1088
	25	33	75	65	59	03234	8489	1104	1100
	26	34	75	65	59	03350	8605	1119	1120
	27	35	74	64	58	03438	8693	1130	1127
	28	36	75	65	59	03517	8772	1140	1112
	29	37	75	65	59	03582	8837	1149	1132
	30	38	-	-	-	-	-	-	-
May	1	39	74	65	62	03694	8949	1163	1147
	2	40	75	64	55	03790	9045	1176	-
	3	41	73	68	74	03770	9025	1173	1176
	4	42	74	67	70	03793	9048	1176	1164

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
May	5	43	74	63	54	03973	9228	1200	-
	6	44	75	66	63	04042	9297	1209	1188
	7	45	75	66	63	04479	9734	1265	1218
	8	46	75	64	55	04561	9816	1276	1254
	9	47	74	66	66	04640	9895	1286	1281
	10	48	75	66	66	04713	9968	1296	1281
	11	49	74	66	66	04812	10067	1309	-
	12	50	75	65	59	04906	10161	1321	1289
	13	51	75	67	48	04972	1330	1294	
	14	52	75	63	51	05051	10306	1340	1303
	15	53	-	-	-	05111	10366	1348	-
	16	54	75	64	55	05165	10420	1355	-
	17	55	75	64	55	05200	10455	1359	-
	18	56	75	64	55	05279	10534	1369	1330
	19	57	75	65	59	05262	10517	1367	1343
	20	58	75	65	59	05315	10570	1374	1350
	21	59	75	65	59	05414	10669	1387	1357
	22	60	-	-	-	-	-	-	-
	23	61	75	63	51	05576	10831	1408	1384
	24	62	75	64	55	05618	10873	1413	1392
	25	63	75	62	48	05749	11004	1431	1401
	26	64	75	62	48	05800	11055	1437	1409
	27	65	75	67	66	05775	11030	1434	1406
	28	66	75	64	55	05789	11044	1436	1502
	29	67	75	64	55	05852	11107	1444	1512
	30	68	75	64	55	06876	12131	1577	-
	31	69	-	-	-	-	-	-	-
June	1	70	75	65	59	07036	12291	1598	1536
	2	71	75	65	59	07123	12378	1609	1548
	3	72	75	65	59	07191	12446	1618	1556
	4	73	75	65	59	07265	12520	1628	1546
	5	74	75	65	59	07399	12654	1645	1590
	6	75	75	65	59	07340	12695	1650	1583
	7	76	75	65	59	07399	12654	1645	1651
	8	77	75	64	55	07451	12706	1652	1673
	9	78	75	65	59	07492	12747	1657	-
	10	79	75	66	63	07539	12794	1663	1681
	11	80	75	66	63	07545	12800	1664	-
	12	81	75	68	70	07545	12800	1664	1666
	13	82	75	65	59	07587	12842	1669	1659
	14	83	75	68	70	07584	12839	1669	-
	15	84	75	65	59	07652	12907	1678	1691
	16	85	75	68	70	07690	12945	1683	-
	17	86	75	66	63	07729	12984	1688	1705
	18	87	75	66	63	07745	13000	1690	-
	19	88	75	65	59	07801	13056	1697	1710
	20	89	75	64	55	07856	13101	1703	-
	21	90	75	65	07918	13173	1712	1722	

Date		Days after loading	Temp. °F		R.H. %	Dial Reading in. x 10^{-4}	Accum. Diff. in. x 10^{-4}	Unit Strain "/" x 10^{-6}	Demec Strain "/" x 10^{-6}
June	22	91	75	68	70	07990	13245	1722	-
	23	92	75	64	55	08049	13304	1730	-
	24	93	75	64	55	08091	13346	1735	-
	25	94	75	64	55	08160	13415	1744	1740
	26	95	75	63	51	08227	13482	1753	-
	27	96	75	67	66	08183	13438	1747	-
	28	97	75	67	66	08165	13420	1745	-
	29	98	75	65	59	08150	13405	1743	1742
	30	99	75	67	66	08168	13423	1745	1747
July	1	100	75	65	59	08250	13505	1756	-
	2	101	75	61	44	08278	13533	1759	1757
	3	102	75	62	48	08280	13535	1760	-
	4	103	-	-	-	-	-	-	-
	5	104	75	67	66	08405	13660	1776	-
	6	105	75	65	59	08510	13765	1789	1769
	7	106	75	63	51	08570	13825	1797	-
	8	107	75	64	55	08611	13866	1803	-
	9	108	-	-	-	-	-	-	-
	10	109	75	65	59	08651	13906	1808	-
	11	110	75	65	59	08713	13968	1816	-
	12	111	75	65	59	08763	14018	1822	-
	13	112	77	65	52	08815	14070	1829	-
	14	113	77	67	60	08860	141115	1835	1769
	15	114	75	75	100	08765	14020	1823	-
	16	115	75	72	82	08748	14003	1820	-
	17	116	76	67	63	08815	14070	1829	-
	18	117	76	67	63	08865	14120	1837	-
	19	118	77	67	60	08894	14149	1839	1774
	20	119	77	66	56	08961	14216	1848	-
	21	120	76	67	63	09000	14255	1853	-
	22	121	76	66	59	09042	14297	1859	-
	23	122	77	68	63	09080	14335	1864	-
	24	123	78	68	60	09102	14357	1866	-
	25	124	77	66	56	09178	14433	1876	-
	26	125	77	65	52	09200	14455	1879	1789
	27	126	76	65	55	09258	14513	1887	1801
	28	127	75	65	59	09460	14715	1913	-
	29	128	75	65	59	02547	7802	1014	-
	30	129	75	65	59	02388	7643	994	-
	31	130	75	67	66	02215	7470	971	-
Aug.	1	131	-	-	-	02045	7300	949	-
	2	132	75	63	51	02002	7257	943	-
	3	133	75	65	59	01990	7245	942	-
	4	134	75	65	59	01972	7227	940	
	5	135	75	64	55	09172	7227	940	-
	6	136	75	65	59	01953	7208	937	-
	7	137	75	65	59	01953	7208	937	-
	8	138	76	65	55	01915	7170	932	-

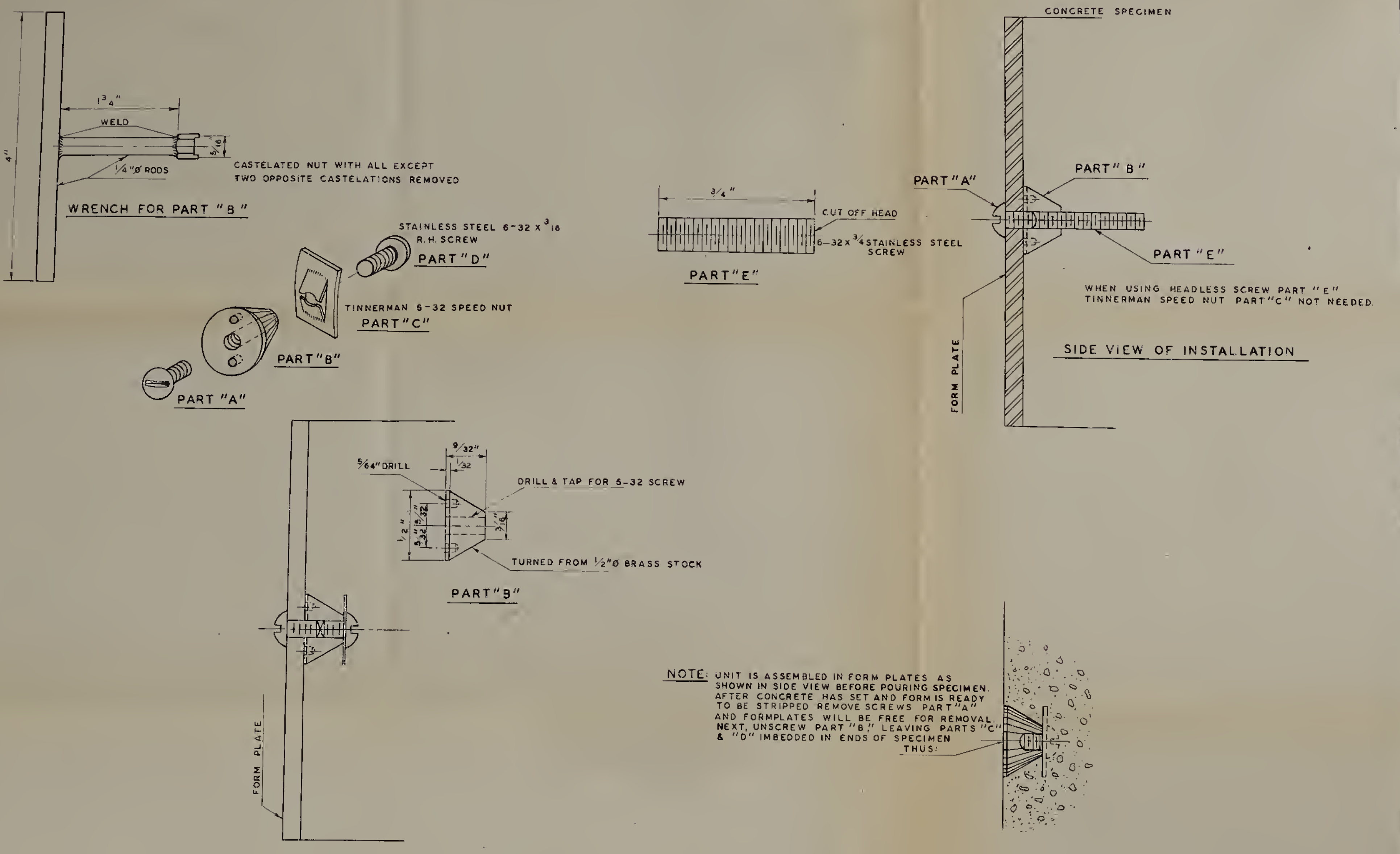


SCALE: 3" = 12"	UNIVERSITY OF ALBERTA
DRAWN BY:	
DATE: AUG. 28, 59	CREEP TEST APPARATUS
MODIFIED FROM STAND. P.C.A. TEST APPARATUS	PLATE NO. 1



MARK	QUAN	MATERIAL	SIZE	LENGTH	REMARKS
1	1	ALUM	3/4" THK		RING AS SHOWN
2	1	ALUM	3/4" THK.		RING AS SHOWN
3	5	BRASS	1/4"—32	2 1/2"	KNURLED THUMBSCREW
4	6	BRASS	1/4"—28	1"	DO
5	3	STEEL	10—32	1"	ROUND-HEAD MACHINE SCREW
6	1	STEEL	5 ⊔ 6.7	1"	
7	1	STEEL	1/4" x 5/8"	1"	STRAP, WELDED TO No 6
8	1	STEEL ROD	3/8" DIA	36"	
9	1	DO	3/8" DIA	36"	WITH FOOT AS SHOWN
10	2	STEEL STRAP	1/4" x 1"	39"	
11	1	ALUM.			CLAMP ASSEMBLY
12	2	STEEL	HEX. 1/4—20	1 1/2"	HEX. BOLT
	2	STEEL	10—32	3/4"	FLAT HEAD MACHINE SCREW
	1		1/4" X 32	2 1/2"	HOLLOW END
	1	STEEL	1/4" DIA	3"	TENSION SPRING
	2	BRASS	7/16" O.D. 3/8" I.D.	1"	SLEEVES

SCALE: 1" = 1"	UNIVERSITY OF ALBERTA
DRAWN BY: [signature]	COMPRESSOMETER
DATE OCTOBER 1, 1959	PLATE No 2



SCALE: 1"= 1" 2"= 1" 3"= 1"	UNIVERSITY OF ALBERTA
DRAWN BY: N. M. Jegrolldx	GAUGE POINTS FOR SHRINKAGE MEASUREMENTS
DATE: JULY, 25. 1959	
DWG. NO. 9 TEXAS A & M COLLEGE TRACED BY: G. LESLIE	PLATE No 3